The AMSAT® Journal

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Volume 25, No. 1 January/February 2002

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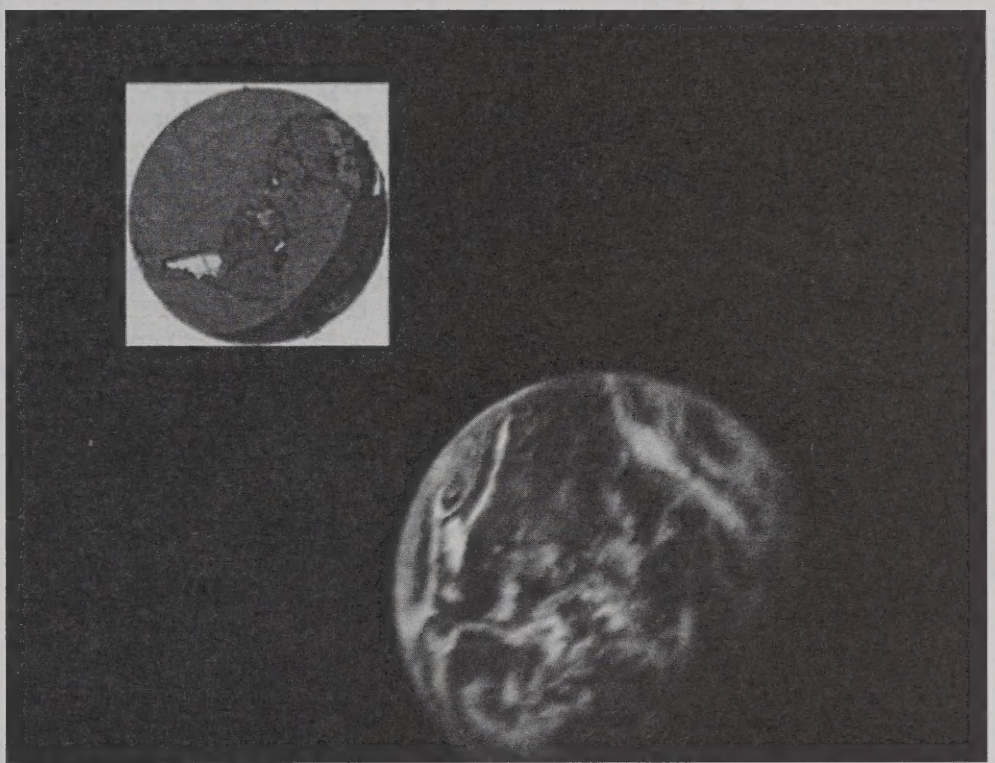

## Greetings from AO-40 High Above Planet Earth!

**A second attempt of taking Earth photographs with AO-40's SCOPE-B camera has again yielded successful results. From Jim White, WD0E's RUDAK experiment command station in Colorado, the SCOPE A (narrow angle) and B (wide angle) digital color cameras onboard AO-40 spacecraft successfully took full resolution images of a mostly illuminated Earth on 15 December 2001. It took six hours for WD0E to download the raw uncompressed image data via 9600bps link. The above 0.100 second exposure was taken from the SCOPE B camera at 1950UTC when AO-40 was at an altitude of 53,000 km. In this picure, most North and South America is illuminated, except northern Canada and Alaska. The shadow is in the upper right quadrant and just over the top of the Earth. Many thanks to the JAMSAT SCOPE Team and WD0E for providing this and other images. For additional images and details regarding the SCOPE project see: *http://www.jamsat.or.jp/scope/index_e.html***

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# Apogee View

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Advertising Office: AMSAT-NA Headquarters, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

*The AMSAT Journal* (ISSN: 1407-3076) is published bi-monthly (Jan, Mar, May, Jul, Sep, Nov) by AMSAT-NA, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703. Telephone: 301-589-6062, fax: 301-608-3410. Periodicals postage paid at Silver Spring, MD, and additional mailing offices. Postmaster, send address changes to *The AMSAT Journal*, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

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*The AMSAT Journal* staff is always interested in article submissions. Whenever possible, text should be on IBM compatible diskettes with hardcopy or original photographs or figures. AMSAT-NA reserves the right to select material for *The AMSAT Journal* based on suitability of content and space considerations. The editors of this publications are volunteers giving freely of their talents, time, and efforts to produce *The AMSAT Journal*.

Hopefully by now you have heard that *Project JJ* has become *Eagle* effective 1 January 2002. The name was submitted by Bill Allen, W7US, of Tucson, Arizona and was selected from a list of 45 names submitted by 29 people. Bill, a life member of AMSAT, is awarded a free dinner at the Amber Rose Restaurant in Dayton Ohio, at the next Dayton in May 2002. Congratulations to Bill!

Around the time you read this, decisions will be made concerning the *Eagle* satellite project. There are two major decisions that have to be made and at the time of writing (a week before Christmas) I am not sure how either of them will turn out.

Firstly, as a result of the shattering events of 11 September 2001, donations to AMSAT have significantly decreased, making the possibility of designing, building and launching a major satellite in 2004 less likely than our original plans. I feel that unless we have a sudden increase in donations I will have to recommend to the Board of Directors that we postpone our launch date by at least one year.

I understand that AMSAT is not alone in having reduced donations, and that many other organizations including most major charities are having the same problem.

Conversely the donations to the President's Club are on schedule but this represents only a small proportion of donors.

The second decision that has to be made concerns the launch vehicle that will put Eagle into Geosynchronous Transfer Orbit (GTO). Members of the Project Committee are working on this and we hope to be able to announce a launch that we can afford in the very near future. Until a decision has been made on the launch, it is virtually impossible to decide the final dimensions of the satellite as these depend on the available secondary payload configurations of the launch vehicle.

Also until the launch contract is signed, the final cost of the project cannot be determined; yes it is a chicken and egg situation.

Of course when we start a project we use the best available information, usually from previous projects, and develop an initial budget. We try to be a little *pessimistic* with the first budget, so that we don't get nasty surprises at the end of the project.

Of course if there were to be any funding surplus then that would be passed on to the next project.

I am very pleased that our *expertise* for developing and building *Eagle* has been enhanced by the addition of some new North American members of the Project Committee and confirmation that some of our existing friends from overseas have offered to design and build equipment for the new project. However I hope that we will get more volunteers to join our committees. As some of our more experienced members decide to retire from active building, we need replacements to fill their places with different and innovative ideas.

***AMSAT Needs You!*** Never let it be said that we are a clique or that we have rejected your skills. We need new people with many skills both technical and non-technical. Don't be afraid to volunteer. If you have the basic requirements we can even provide additional training. I know ... I volunteered and eventually became the President (after training).

I ask you to please take time to read the article on the AMSAT Strategic Plan that appears on the next page of this issue. This article presents the Plan, how it was developed, but most importantly tells how you can get involved in various AMSAT endeavors. Also, take time to complete the AMSAT skills inventory that appears on the AMSAT WWW page as well as in this issue (see pages 8 & 9). Completion of your inventory will allow us to identify members interested in performing much needed AMSAT tasks. So, please fill out the survey and send it in to the AMSAT office.

The success of UO-14 and AO-27 has led the Board of Directors to believe that many of you enjoy working this type of satellite and collecting grid squares. Others prefer the AO-40 satellites with the long access times and there is often a demand for other types of satellite using various modes. It is very difficult to please all of our members with each type of satellite, however I am trying to find out the plans of the various AMSAT's around the world so that between us we can develop an organized schedule of different types of satellites using various modes and frequencies.

Coordination of our efforts may lead to greater satisfaction from the worldwide membership, however when I review the number of satellites that are currently in orbit and available to be worked, I am amazed at the capability that already exists.

Take a look at the weekly AMSAT News Service (ANS) posted on the AMSAT-BB and available by e-mail subscription to ANS@amsat.org. There is a comprehensive listing of the Amateur Satellites and their current status. In addition I will try and collect a full listing of all planned amateur satellites and have a list published on the AMSAT WWW pages.

In conclusion, may I pass my very best wishes to you all in 2002, and may your involvement with AMSAT be enjoyable and mutually rewarding. Again, please remember to support the organization, for your support means more satellites.

73,

Robin Haighton, VE3FRH, President ■

# Defining a Strategy for AMSAT:
## *a.k.a. What Do We Want AMSAT to Be?*

**Bill Burden, WB1BRE and Russ Tillman, K5NRK**

- What type of satellites should AMSAT's develop next?
- What technologies should be placed on future AMSAT satellites?
- What type of educational outreach should AMSAT provide to teachers and students?
- How do we partner with fellow AMSAT organizations?
- Why isn't *The AMSAT Journal* published electronically?
- How can I get involved in building a satellite?
- What type of support should AMSAT provide to university satellite projects?

Good questions! Those who participate in the AMSAT-BB forum have seen these and similar *what, why, when, and how questions* posted by concerned and interested members. As most readers of AMSAT-BB know, when such questions are asked on AMSAT-BB, much innovative discussion takes place and opinions and well-thought-out answers are provided. Unfortunately, however, the thread eventually disappears into cyberspace and discussion moves on to other topics, leaving some to question what is the final outcome of such open and healthy discussion? Perhaps an overall, encompassing, and complete answer to these and other questions deals with the issue of *what do we want AMSAT to be?* That is, once that question is clearly defined, answered, and communicated among members, the context of the answers to the above questions can be better understood; such has been the difficult task of the AMSAT Strategic Planning Committee. This article presents the *current answer* to the question of *what do we want AMSAT to be*, describes the results of AMSAT strategic planning efforts, and, most importantly, defines your role in becoming an active participant and supporter of AMSAT's future.

At the 1997 AMSAT Annual Meeting and Space Symposium held in Toronto, the AMSAT Board of Directors (BoD) discussed the need to start looking beyond Phase 3D efforts. That is, the BoD felt it was necessary to consider formulating a strategy for setting the direction of AMSAT-NA in a post-launch Phase 3D environment. As a result, then-President Bill Tynan, W3XO and Executive Vice President Keith Baker, KB1SF laid the groundwork by creating a Strategic Planning Committee to develop strategy recommendations for the BoD. Bill Burden, WB1BRE was appointed Vice President for Strategic Planning and Chair of a Strategic Planning Committee as he had recently been involved in revising the ARRL strategic planning process and his experience would prove invaluable to AMSAT's effort. Other members of the AMSAT Strategic Planning Committee included Barry Baines, WD4ASW; Keith Baker, KB1SF; Steve Bible, N7HPR; Ken Ernandes, N2WWD; Bdale Garbee, KB0G; Mike Gilchrist, KF4FDJ; Robin Haighton, VE3FRH; Dan James, NN0DJ; and Russ Tillman, K5NRK. In addition, Martha Saragovitz, AMSAT Corporate Secretary served as an ex-offico member of the committee and Perry Klein, W3PK (Founding President Emeritus)was a very helpful resource, providing the committee with clarification on past AMSAT endeavors. Their broad and detailed knowledge of AMSAT and their continual encouragement proved invaluable to the committee.

### The Textbook Process: The Value of a Strategic Plan

Before describing the AMSAT Strategic Plan and how it was developed, let's spend a moment discussing what a strategic plan is. A textbook definition of *strategy* is a pattern or plan that integrates an organization's major goals, policies, and action sequences into a cohesive whole[1]. In layman's terms, a strategic plan identifies what an organization is, what it finds important, what it wants to do and how it will go about doing it. Given the fact that all organizations have limited resources, they can't do everything. As a result, choices or decisions must be made on what to do. AMSAT is no different. A strategic plan simply helps organizations make good and logical choices. A strategic plan also serves as a *common sheet of music* informing members what the organization hopes to do.

Strategic plans are tied together using a process that identifies how the organization will go about implementing the plan. When new proposals, challenges, or opportunities appear before an organization, an *acid test* should be made to compare them to the strategic plan to see if they are consistent with the organization's mission, values, and vision. If not, the strategic plan must be modified; while at other times, the proposal must be turned down because it simply doesn't fit into the priority items.

Typical components of a strategic plan are:

• **Mission Statement:** Describes the organization in terms of its purpose. That is, why does AMSAT-NA exist? The mission statement also explains what we seek to accomplish and usually includes a sentence describing the business of the organization (the method or activity through which we fulfill our purpose).

• **Value Statement:** Describes core beliefs and principles that guide the organization.

• **Vision Statement:** Presents an image of what success will look like for AMSAT-NA over the next three to five years. Together, the mission statement and the vision statement represent a shared, cohesive idea of what this strategic plan hopes to achieve.

• **Strategic Goals and Objectives:** Presents the major outcomes and details on the execution of the Strategic Plan.

One way to look at these components is that they go from very general (mission statement) to very specific (strategic objectives) in a related and logical process. Also note while all of these components are easily defined and laid out in a textbook, developing a well-thought-out strategic plan is a very difficult challenge for any organization. Again, AMSAT is no different.

### The Real Process: The Right Way, Wrong Way, and AMSAT Way!

The AMSAT Strategic Planning Committee

began the task of defining an AMSAT strategy by discussing a variety of issues via e-mail. As a result of this effort, committee members were able to mutually agree upon basic strategic planning principles, methodologies, and preliminary direction; the nuts and bolts that are used in developing a strategic plan. In addition, several assumptions were identified, discussed, and refined that served as reality checks and proved useful in developing a strategic plan. For example, it was suggested that the core of satellite designers and builders or the membership might be *worn out* after completing Phase 3D. Interestingly enough, the committee learned that the lengthy Phase 3D experience had honed designer and builder skills and that they stood ready to take on new challenges even as Phase 3D was being prepared for launch. Meanwhile, a tougher committee task was to clearly understand the process in which AMSAT's next project(s) are defined and forged. This process had to also include the assurance that AMSAT membership would support such project(s). The committee also identified and assessed various significant AMSAT assets to confirm that the necessary resources and range of skills were available to implement a multi-faceted and dynamic strategic plan. Included in this assessment was a check to see if the passion was still there; were people still intensely interested in seeing AMSAT-NA move forward and provide more innovative satellite resources to the amateur satellite community? The answer was a solid "YES" and so, the committee plunged ahead!

Don't let this article fool you into thinking that developing an AMSAT strategy was an easy cookbook process. It wasn't. (Your authors just hide the bloodstains well!) Rather, virtual development of these principles, methodologies, and assumptions using e-mail was very difficult, took significant time and dedication, and was as exciting as going to the dentist! (In fact, strategic planning reminded the committee too much of what they see at *real work* instead of Amateur Radio! It was also a two-step forward and one-step back learning experience.) But with perseverance, e-mail discussion identified and forged many key issues via open and candid discussion allowing them to be matured, refined, and stirred together into a game plan. However during this process, the committee questioned whether the final game plan really represented the best interests of AMSAT membership or did it instead represent the best interest of the committee? Or, for that matter, was the final game plan merely a collection of individual interests? Inasmuch, some ground-truth verification was needed with AMSAT members. As a reality check, the committee hosted a strategic planning workshop at the AMSAT Annual Meeting and Space Symposium held in Portland, Maine in November 2000. This workshop was well attended by a diverse cross-section of AMSAT members who voiced many well-thought-out ideas about AMSAT's strategy; some that paralleled the committee's developed positions, others that went beyond the committee's thinking. The results of the workshop proved invaluable to the committee, by providing a variety of new considerations, verifying it was on track with its methodology and assumptions for developing a strategic plan for AMSAT, and confirming that it had membership general support for doing so.

### Putting It All Together: So What Do We Want AMSAT To Be?

The results of the strategy workshop, along with a draft mission statement, were presented and discussed at the Portland AMSAT BoD meeting. After participating in the workshop, several BoD members said they came away with a better understanding of what the strategic planning process is (and isn't) and more importantly, how such a process could benefit AMSAT. The BoD reconfirmed their commitment to develop a strategic plan and suggested that the Strategic Planning Committee meet face-to-face to forge a strategic plan for their consideration and implementation. The Strategic Planning Committee met on a weekend in February 2001 and with the persistent and gratis help of Barbara Saragovitz (a strategic planning facilitator for the FAA and beloved sister of Martha), the committee defined AMSAT's mission, values, vision, strategic goals, and objectives. In developing this plan, the committee also referred to several AMSAT-NA enabling documents for guidance. The AMSAT Bylaws and Articles of Incorporation provide the best description of our business, purpose, and what values provide inspiration and guidance to the Board of Directors and officers. In addition, the committee examined the organization's launch history as included in a document entitled *Satellite History Charts*, prepared by Martin Davidoff, K2UBC in 1998. Armed with these resources and other background information from past e-mail discussions and the strategic planning workshop, the following strategic plan was submitted to the board for adoption and implementation.

### AMSAT-NA Mission Statement

*AMSAT-NA is the principal North American Amateur Radio organization supporting the development of skills and specialized knowledge in the art and practice of Amateur Radio communications, as well as technology and science, in space. We develop, build, and operate satellite systems for Amateur Radio communications and experiments using Amateur Radio stations throughout the world.*

### AMSAT-NA Value Statement

*We Value:*

** the radio spectrum as a fundamental resource*
** experimentation and encourage innovation*
** sharing information and helping others to achieve their personal goals*
** education and training, and*
** prudent fiscal management*

### Our Vision

*We are a vibrant organization providing continuous, diverse, and innovative Amateur Radio satellite services anywhere in the world, at any time, through an inventory of healthy satellites.*

### Strategic Goals

The Strategic Planning Committee has evaluated the current state of the organization, discussed AMSAT-NA's strengths and weaknesses, and what we have learned from all the experiences as AMSAT-NA. As a result, we recommend that AMSAT-NA re-establish its own presence in space through the development and deployment of two or more *made by AMSAT-NA* satellites in the next 5 years, employing advanced technology and innovative communications systems. The Project Committee that was recently put in place should be the lead group in making this happen by establishing se-

lection criteria and an inclusive review process for recommendation of appropriate projects to the Board of Directors.

In addition, the committee recommends that AMSAT-NA establish a policy and a structure to interface and mentor university-based small satellite projects. By successfully developing mentoring and teaming arrangements, we can ensure a continued source of satellites incorporating more mature communication modes such as Mode A, Mode B, and Mode J, FM and SSB. This will accomplish three things:

1. We will become directly involved in growing the next generation of satellite designers and developers.

2. We will continue to provide resources for existing satellite operators using available equipment and draw other Radio Amateurs into the amateur satellite community.

3. We will put our fingerprints over the design process of these satellites and enhance recognition of AMSAT's contribution to small satellite design.

In order to develop a plan for achieving the vision articulated in this document, the committee recommends the four strategic goals for AMSAT-NA. These are coordinated approaches written as outcome statements to guide the AMSAT-NA Board of Directors and officers. Under each goal, we have developed a specific set of objectives that are time-phased, measurable, and support the achievement of the goals. The plan describes the types of objectives set out for each goal.

### Strategic Goals and Objectives for AMSAT-NA

**A. *AMSAT-NA will develop satellites and related equipment for continuous Amateur Radio communications.***

Specifically, AMSAT-NA has as a major milestone the development and deployment of two amateur communications satellites in the next five years. The Project Committee will review proposals and recommend designs to the BoD. A design team will be created and will develop a plan for using skills and technologies to support the effort. In addition, suitable launch opportunities will be identified and system design efforts will coordinate the overall communications and mechanical designs.

In parallel, we will work to develop a plan for interacting with universities and other educational entities to help mentor their efforts and to ensure that satellite designs meet the criteria established by IARU for the use of amateur satellite spectrum. In addition, we will look at teaming with educational institutions to help develop the next generation of amateur (and other) satellite designers.

**B. *AMSAT-NA will provide members opportunities to participate and contribute on many levels.***

One of the areas in which we need to improve is matching member skills with tasks that need to be done. As planning for the development of our satellites proceeds, we


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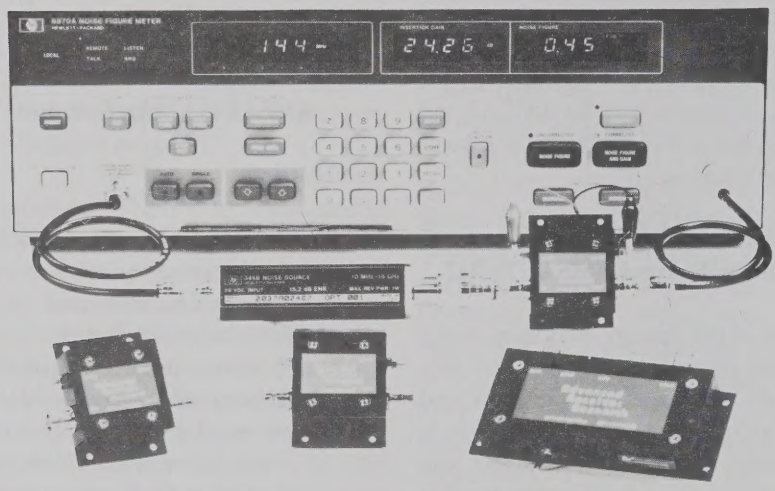

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| SP144VDA | 144-148 | <1.1 | 15 | 0 | DGFET | $67.95 |
| SP144VDG | 144-148 | <0.55 | 24 | +12 | GaAsFET | $109.95 |
| SP220VD | 220-225 | <1.9 | 15 | 0 | DGFET | $59.95 |
| SP220VDA | 220-225 | <1.3 | 15 | 0 | DGFET | $67.95 |
| SP220VDG | 220-225 | <0.55 | 20 | +12 | GaAsFET | $109.95 |
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will begin to understand the types of skills that will be required and the people we will need as volunteers. To assist in matching people with needs, we are developing a skills and interest identification resource that will allow members to tell us in which areas their particular skills lie and what types of tasks they would like to become involved in. (*Editor's Note: See AMSAT Skill Survey on pages 8 and 9 of this issue.*) As part of this process, we will work to publicize our specific needs, both physical and intellectual.

In addition, the Projects committee will endeavor to review and respond to unsolicited proposals for satellite-related projects.

Finally, we will be reviewing the operating awards program in view of the new satellite resources now available. A new operating award has already been announced and more will follow.

**C. *AMSAT-NA will be the primary resource for amateur satellite information, training, and education.***

Currently, AMSAT-NA has a good range of materials that support the interests of both the new satellite operators and the seasoned veterans. We want to expand that base to include AO-40 user manuals and more material on digital satellites. *The AMSAT Journal* includes a lot of useful information both for reference and training. The publications team is looking at providing *The AMSAT Journal* and other archived material on CD-ROMs. In addition, we will be publishing an annotated bibliography of amateur satellite articles. As new satellites come on line, we will need a new generation of control operators to manage the new resources. Work is in process to develop and implement a certification program for control operators, building on the experience and knowledge of the existing pool of experts. (*Editor's Note: The first Area Coordinators' Tool Kit was released in mid-2001 and an update is planned for Spring 2002.*)

Our Field Operations team is our direct link to the amateur community and we plan to improve support for them through the new resource CD-ROM recently published. In addition, the visibility of the Field Ops on our WWW site will be upgraded. (*See http://www.amsat.org/fieldops/*)

In order to encourage more AMSAT members to write articles for *The AMSAT Journal* and other publications, the publications team plans to develop and distribute a style guide for writing for AMSAT-NA.

**D. *AMSAT-NA will acquire sufficient resources to support our Vision.***

All of the efforts and initiatives described in the first three objectives will require financial as well as physical and intellectual support. The newly formed Business Development Committee will have as its major task the development of a *Master Plan* for fund-raising from a variety of grant, corporate, organization, and individual sources. This plan may include plans for fund-raising programs, development of a PR plan to highlight the accomplishments of AMSAT-NA, and other plans to enhance and increase the voluntary contribution process. In addition, the Board of Directors will implement a periodic review of the dues structure and acquiring sufficient financial and human resources to support our satellite development goals.

As we begin the implementation phase of the strategic plan, we will continue to keep an *open dialog* with the membership both to keep you informed of the progress and to make members aware of where we need help and support.

A strategic plan is not a one-time effort. As we know too well, the environment in which we live and work can change at any time and the plan may be affected by changing circumstances. The committee and the Board of Directors will periodically review the plan and make any changes or additions that may be needed to keep us headed in the right direction. The strategic plan will be a *living document* and the blueprint for achieving our vision of putting two satellites into orbit in the next five years.

This is an exciting period in AMSAT-NA's history with our efforts on AO-40 finally paying off and with the challenges of new small satellite development in the academic community.

Our ability to achieve the goals we have set for ourselves over the next few years will clearly put the stamp of leadership in Amateur Radio space communications on AMSAT-NA!

**What's In it For Me?**

The above plan is aggressive, dynamic, and covers many different facets of what AMSAT does or wants to be. Also, this strategic plan is not totally inclusive of all that AMSAT does; rather, it covers areas of *immediate concern*. Hopefully the above plan clearly identifies what AMSAT considers *important* over the next few years and as a result, will be focusing its scarce resources on accomplishing these key tasks. These are the areas where your officers will be involved over the next few years. In fact, readers should be able to recognize where progress has (or hasn't) already has been made on this plan.

The AMSAT BoD gave preliminary approval of this plan in February 2001 and final approval in October 2001. As an attempt to make the plan a living document, it is the BoD's intent to review, modify, and if needed, expand this strategic plan on an annual basis. (*Editor's Note: For additional discussion, see the BoD Minutes on page 24 of this issue.*) On behalf of the BoD, the Strategic Planning Committee has been charged with the task of monitoring, reviewing, and recommending to the BoD revisions to the plan. However, neither your Strategic Planning Committee, nor your BoD wants to make these revisions in a vacuum. Rather, membership input and critiquing are urged via e-mail to *strategy@amsat.org* (privately) or *amsat-bb@amsat.org* (publicly). With all members' help, we can improve the strategic plan and process for the good of all AMSAT members.

So what does AMSAT want to be? Simply put, from the Strategic Planning Committee perspective, AMSAT is an organization that can clearly identify, articulate, and accomplish the things it needs to do for the good of its members. Hopefully all of those things will strongly support your Amateur Radio satellite fun!

**References**

1. Quinn, James Brian, *Strategies for Change: Logical Incrementalism*, Richard D. Irwin, Inc., 1980.■

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# AMSAT Volunteer Survey

Version: 04 December 2001

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AMSAT depends on volunteers to succeed in the amateur-satellite program. Can you help? Please let us know how by completing and mailing this Volunteer Survey to AMSAT, P.O. Box 27, Washington, DC 20044. ***If you would like an on-line version of this Survey that you can complete and return by e-mail, please send a request to volunteer@amsat.org.***

This information is for AMSAT official use only and results will not be released outside of AMSAT. **Thank you very much for your help!**

Date: _____ Call Sign: _____ AMSAT-NA Member (Number)? _____

Are you a member of another national AMSAT organization? If so, which? _____

Name: _____

Address: _____

City: _____ State or Prov: _____ Country: _____

ZIP or Postal Code: _____

e-mail address *(are you set up at call@amsat.org yet?)*: _____

Telephone(s) - Day: _____ Night: _____ Cellular: _____

Please give us some information on your education, experience and training. (Any degrees? Any special training relevant to AMSAT's mission?)

_____

_____

What is your profession and employment (where do you work and what do you do?) If you are a student, what is your major? If you are retired, where did you work and what kind of work did you do?

_____

_____

How many hours per week might you be able to help? _____

**Please put a letter in the box in front of categories where you can help.**
***NOTE: Please use E (experienced), G (good), F (fair) or B (beginner-willing to learn).***

***Design and Construction:***

[ ] 100 VHF Circuit Design
[ ] 110 Microwave RF Design
[ ] 115 Microwave RF device fabrication and checkout
[ ] 120 RF PC board layout
[ ] 125 RF PC board fabrication and checkout
[ ] 130 VHF or microwave Antenna Design, Fabrication, testing

[ ] 140 Embedded control computer system & digital design
[ ] 145 Spacecraft control computer fabrication and checkout
[ ] 150 Control software creation
[ ] 160 Digital or analog PC Board Layout
[ ] 165 PC board fabrication and checkout
[ ] 168 Quality assurance

[ ] 200 Spacecraft Mechanical Design & Analysis
[ ] 210 Thermal Design & Analysis
[ ] 220 Spacecraft Stabilization System Design
[ ] 230 Propulsion System Design
[ ] 240 Metal-working
[ ] 250 Spacecraft cabling design and fabrication
[ ] 255 Spacecraft checkout

***Spacecraft Operation, Control and Monitoring:***

[ ] 300 Digital signal processing, signal and modulation techniques
[ ] 305 Communications systems design
[ ] 310 Orbital Analysis
[ ] 315 Telemetry retrieval
[ ] 320 Creation of spacecraft performance analysis software
[ ] 322 Spacecraft performance analysis
[ ] 325 Spacecraft control and maintenance
[ ] 330 Project documentation and technical writing
[ ] 335 Interface management and control
[ ] 340 Satellite command station
[ ] 345 Spacecraft data archiving
[ ] 348 Design or production of reproducible ground stations

***Operating Interests:***

[ ] 400 VHF Satellite Operation
[ ] 410 Microwave Satellite Operation
[ ] 440 School & Other Satellite Demonstrations
[ ] 450 Planning or coordinating demonstrations
[ ] 460 HF nets or bulletin stations
[ ] 465 VHF/UHF-FM nets or bulletin stations
[ ] 470 EME (What bands?):
[ ] 480 Digital Modes (such as PSK31 or packet radio):
[ ] 490 Construction of your own equipment. (What have you built?):
[ ] 499 Others (such as spread-spectrum, ATV or SSTV):

***Administrative Assistance:***

[ ] 500 Fundraising
[ ] 510 Legal, especially Copyright, Patents, Trademark, corporate & trusts or estates
[ ] 520 Help with *The AMSAT Journal* and other general writing or editing of AMSAT publications
[ ] 525 Journal layout or graphics (Any access to publishing or printing facilities?)
[ ] 530 Ad design and sales
[ ] 540 Translation (what languages?):
[ ] 550 Administration, correspondence
[ ] 552 Serving as Area Coordinator
[ ] 555 Helping at hamfests
[ ] 556 Speaking to radio clubs
[ ] 557 Helping hams get on the satellites
[ ] 558 Education liaison (with whom?):
[ ] 560 Database Management (membership, surveys, keeping track of donations, etc.)
[ ] 570 Video production and editing
[ ] 580 Photography
[ ] 590 Web Design (Can you design, develop and maintain special pages for the Web?)
[ ] 595 Web-casting
[ ] 597 Regulatory liaison (with whom?):
[ ] 598 Sales, advertising and public relations

***Finance and Accounting:***

[ ] 600 Bookkeeping
[ ] 610 Accounting
[ ] 620 Auditing
[ ] 630 Financial management and investment planning

Do you have any special resources or contacts that might benefit AMSAT? (Examples might be machining, assembling, printed-circuit fabrication or test facilities you might have access to.)

Additional Comments:

***Thanks again for your help!***

***Please return your survey to AMSAT, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703***

# Observation of the AO-40 Downlink Signals

**Franz J. Bellen, DJ1YQ**

*Translation from the AMSAT-DL Journal by John J. Bubbers, W1GYD*

AO-40's modes of operation have been activated in LS and US modes. The squint angles vary widely; they achieve values between 0 to 70 degrees. For this reason the field strengths of the downlink signals flucuate considerably.

This writer's receiving setup was described previously in detail. With this installation the beacon and SSB signals were received on 27 July 2001 and 31 July 2001. The results are further presented and discussed below. In the period examined the S-2 transponder and the middle beacon on 2401.323 MHz were in operation. The satellite's attitude was ALON/ ALAT = 333/3 degrees.

In this presentation, the intenral noise of the receiving installation will not be considered. The basis for the investigation is the receiver noise signal with an antenna connected (S-meter indication). The absolute value is therefor only a limited quality representation; the up and down variation in magnitude is however, an important factor, which will be treated later in detail.

The indication of the noise on the S-meter is a measure of the amplification of the converter, among other things. It should be set high enough so the noise signal does not exceed S3. A higher value only limits the indicator's range, and has no advantage and brings the signal to early saturation. The indicator should not be much lower in order to have good control over the satellite signal.

For the examinations of the S-meter signal, the antenna azimuth and elevation, the MA value as well as the squint angle were recorded in tabular form in time increments of 100 ms or 1s depending on the computation.

### Ground Noise and Sun Noise

The received noise is dependent on the elevation angle of the antenna installation. At an elevation of 0°ground noise is received, which is about 3 dB above the mean noise-signal. This decreases with increasing elevation. At about 20° this influence has disappeared (Figure 1). If satellites are received in this elevation region the useful signal will be reduced by a maximum of 3 dB. The standard deviation of this noise signal is 0.7, which means that 68 percent of all measured values have a variation of less than 0.7 dB from the average value. This further means that a satellite signal is automatically burdened with this variation, if there is no theoretical statistic indicated.

The Sun is also a noise source, which cannot be ignored when receiving on 2400 MHz. If the antenna is pointed at the Sun, then the noise is increased by about 2 dB (Figure 2). It is also valid here, as previously, that the useful satellite signal is reduced by 2 dB if the signal comes from that direction. While performing this experiment the antenna was set to the Sun's elevation of 57°and the antenna's azimuth was changed. The experiment is suited as a control measurement for a receiving installation. If the effect of the sun is not measurable, then the receiving installation is not well suited for satellite operation.

In Figure 3 the antenna was set at the Sun's azimuth or 228° and the elevation was raised from 0° to 90°. The ground noise and the sun noise are readily recognizable. In an unfavorable combination the signal to noise ratio will be reduced by up to 5 dB at sunrise on a low-elevation satellite. The measure-

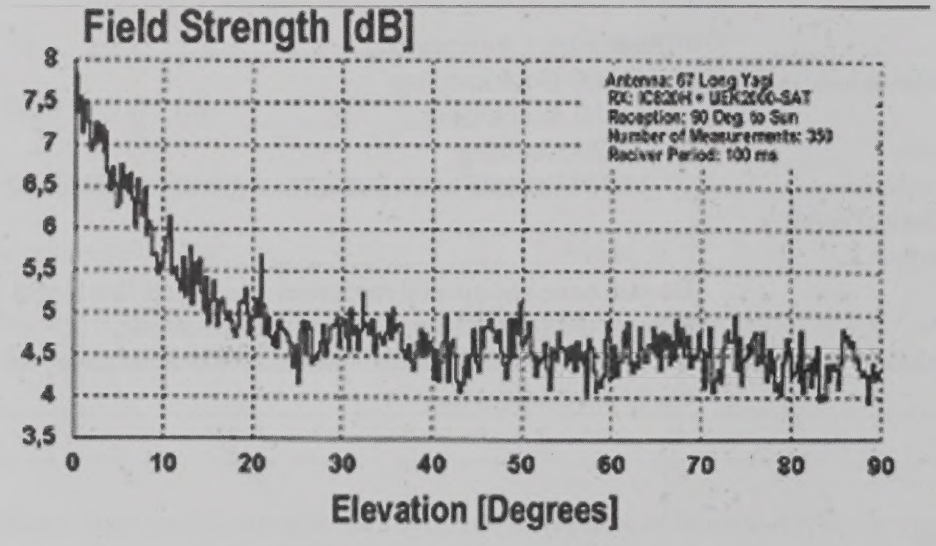



Figure 1. 13cm Noise = f(Elevation).

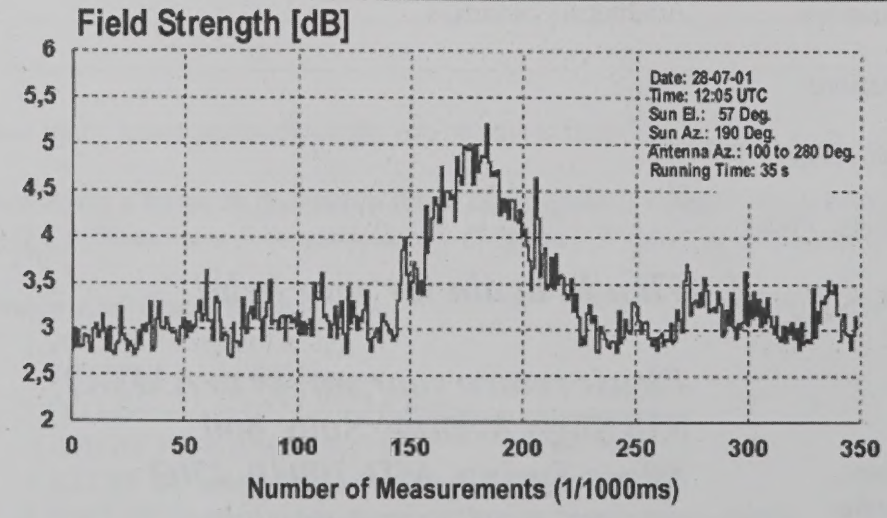



Figure 2. Sun Noise on 13cm.

ment values in Figures 1 to 3 were in 10 Hz intervals.

### The Satellite's Beacon Signals

These were recorded at different squint angles. The signal inquiry followed every second and the total recording time was five minutes. The ground noise was at 4.5 dB for all the recorded points. To determine the absolute amount of the satellite field strength this value must be subtracted from the actual value of the curve.

Figure 4 shows the beacon signal of AO-40 at a squint angle between 70° and 60°. The MA-value was between 5.5 and 6.5. Because of the relatively short distance to the satellite, it was 9,500 km, the field strength is relatively high in spite of the poor squint angle. It had a mean strength of 19.5 dB. Note the wide variations. The standard deviation is 3.3 dB. At that level of large field strength differences there are errors in the telemetry in spite of the high signal level.

Even at a squint angle of 38 to 34 degrees there is no improvement in the beacon signal (Figure 5). The average signal was 20.6 dB with a standard deviation of 3.4 dB. The satellite distance was about 14,500 km. Even here there were errors in the telemetry decoding. Since the MA value was between 10 and 12, the magnetorquers were turned on. The large field strength variation of the beacon signal is also present on the SSB signals. This leads to intelligibility difficulties in spite of the acceptable audio amplitude.

A substantial improvement in the beacon signal can be seen in Figure 6. The squint angle has been improved by changing 30 to 50 degrees. The field strength rose to 22.7 dB and the standard deviation was lowered to 1.3 dB. The SSB signals were perfectly understandable. An ideal situation is presented in Figure 7 with a squint angle of 5-6 degrees. The standard signal value is 18.9 dB with a standard deviation of only 0.9 dB. If one considers that the noise has a value of 0.7 dB (see Figure 1) then the beacon signal has an extremely constant value. Subtracting the basic noise value of 4.5 dB, then the beacon signal is 14 dB above the noise level. In this experiment transmit and receiving antennas were practically looking directly at each other with a squint angle of 5°.These are ideal conditions for the reception of beacon signals and SSB operation. At this time

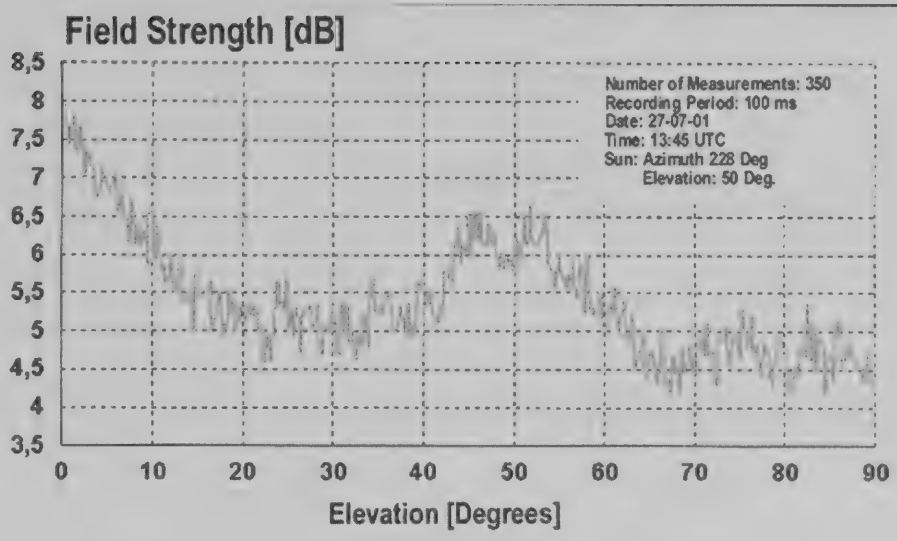



Figure 3. Ground and Sun Noise Versus Elevation.

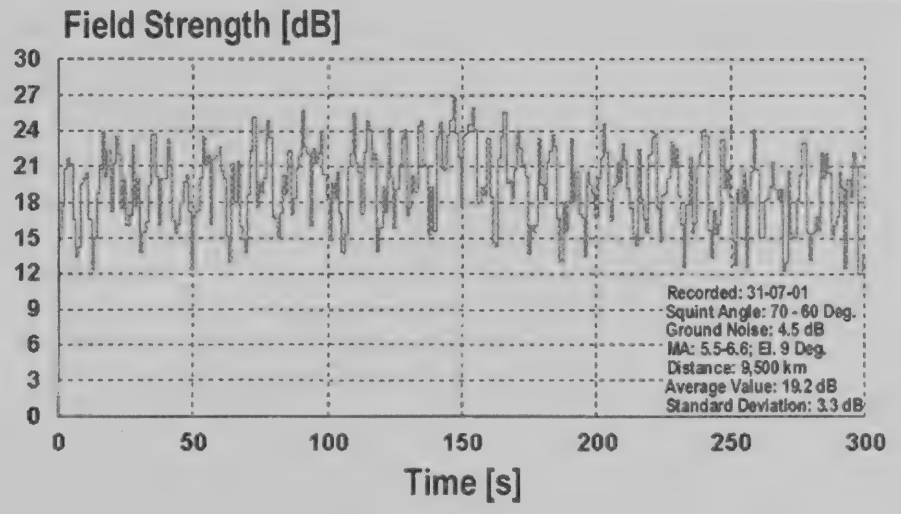



Figure 4. Field Strength of the AO-40 Beacon at a Squint Angle of 70-60 Degrees.

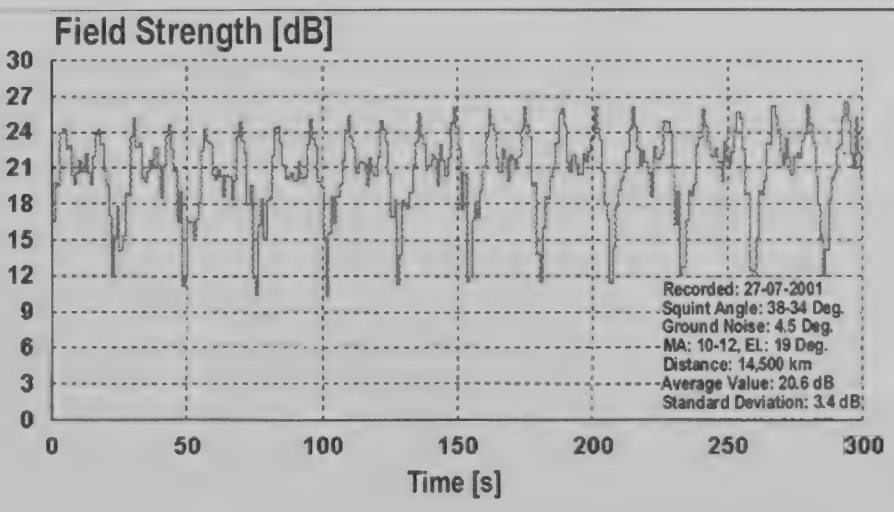



Figure 5. Field Strength of the AO-40 Beacon at a Squint Angle of 38-34 Degrees.

the satellite was at a distance of 35,000 km.

### Examination of a SSB Signal

Reinhard Richter, DJ1KM, provided a good signal that was both loud and intelligible. The test results are shown in Figure 8. The squint angle was 5°, and the satellite was at MA 37.

It is well understood that DJ1KM chose his uplink power so that the transponder was not overwhelmed (peak value of the SSB signal is less than the beacon signal).

### Summary

AO-40 has now reached a condition, which permits outstanding contacts while simultaneously making highly technical demands. At this point I would like to thank all those who took part in the satellite project. The current orbit promises many years of reliable communication opportunities. ■

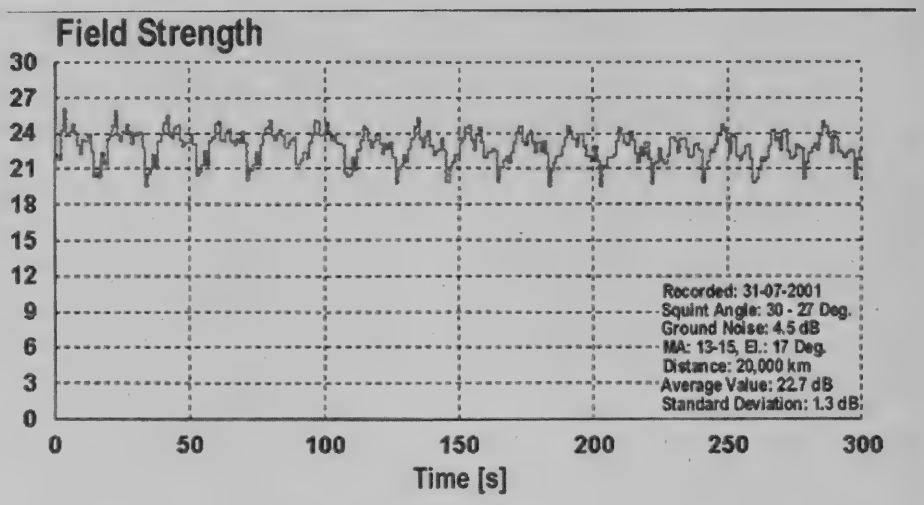



Figure 6. Field Strength of the AO-40 Beacon at a Squint Angle of 30-27 Degrees.

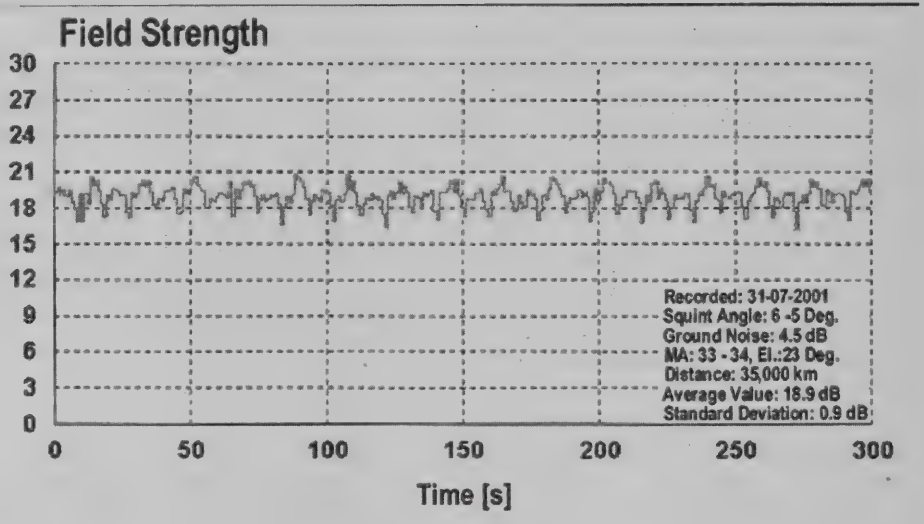



Figure 7. Field Strength of the AO-40 Beacon at a Squint Angle of 6-5 Degrees.

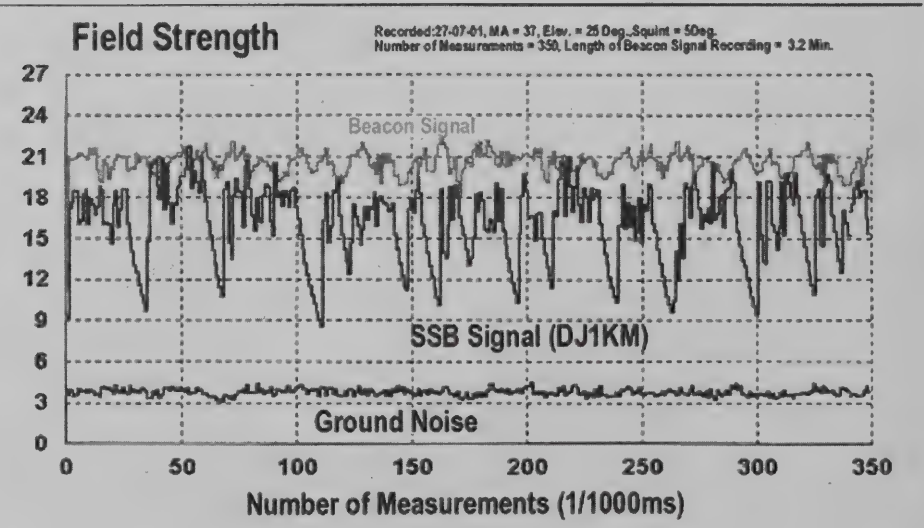
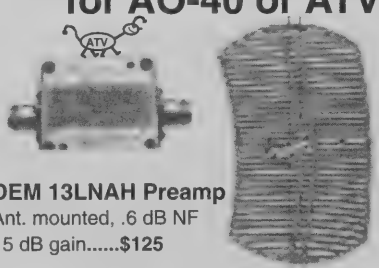



Figure 8. Beacon and SSB Downlink on AO-40.


**2.4 GHz Ant. & Preamp for AO-40 or ATV**



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# Visiting Normandy to see Historic Sites and work AO-40

## Rolf Niefind, DK2ZF (AMSAT member since 1969)

After ten years we had several good reasons to travel once again to Normandy and Brittany, France. The XYL (ex UA9) wanted to see again the cloister Le Mont San Michel in the St. Malo bay and I wanted to revisit D-day invasion sites, Utah and Omaha beaches and cemeteries. Furthermore, we wanted to see some radio history sites maintained by the French relating to early radar and radio navigation. Also, the AO-40 equipment needed a good checkout for a planned Pacific 10-country trip in 2002.

The motorhome, already reserved in July, was waiting. The following equipment was available: a FT-847, a Kuhne transverter and 0.7 db NF preamp for 2401 MHz. For antennas I brought a 10 el and a 15 el Flexa Yagi for the 70 cm uplink. These are extremely light, weighing just under 2 and 3 lbs. respectively .For the 13 cm downlink I brought the 30-turn helix by Wimo, which I had used in May already. Having just received the G3RUH patch feed I packed this as well as a (undrilled) 2ft dish. The antennas were supported by a 5 ft aluminum pipe the top of which was such that I could attach the antennas mounted on a cross boom w/o using a step ladder. Elevation was adjusted by listening. A three-foot pipe was used to secure the elevation, which also provided leverage. Azimuth was determined by the good old magnetic compass. For satellite data I had printouts with the front and back of the pages printed to save on weight. From experience I found adjusting az/el about once every hour to be sufficient. A PC, or laptop, on a dx-pedition would definitely *overkill* for AO-40.

The first night, high above the cliffs of Cape Gris Nez, was too stormy and no attempts were made to erect the antennas. The second night we stopped at Cape d'Antifer. This is the site where in the night of 27 February 1942, British Raiders under the command of Major Frost stole a Wuerzburg radar from the Germans. This episode is well documented in the book by R.V. Jones titled *The Most Secret War*. I mounted the 10 element Yagi and the 30 turn helix but the noise level which is S2 to 3 at home, was at S-6 and on 432 MHz I heard strong Sydelis signals with the typical *toc toc toc* sometimes to S9. As another storm was brewing I took the antennas down. Another day went by without AO-40.

After traveling most of the day (3 October 2001) we reached the bay of St. Malo with the famous Le Mont St. Michel. While the XYL went to see St. Michel, I quickly erected the antennas to get ready for an opening to Japan. This time the receiver noise was at S1 to 2 and at an elevation of just under 1° I called CQ hearing my own signal with 539. At 1410 UT I worked JA1IRH, the JA3APU, and a little later OK1VHF. At 1458 local the first SSB contact with VR2XMT in Hong Kong. Two more SSB contacts with DLs concluded this first session.

When the XYL returned from St Michel I talked her into holding the dish and the patch feed and I was surprised to hear numerous weak signals never heard before, and the beacon was a good two S units louder. The XYL protested further experimentation since her arm was tiring, having to hold the yet undrilled dish and the patch feed.

After two days at St Michel we headed for the La Hague peninsula. There we looked for a site with a clear sight to the West. I was still impressed by the dish/patch feed performance and kept thinking about drilling some holes so the dish could be mounted. While fueling our vehicle at a gas station we found a German speaking Frenchman who recommended a small shop, which could do this job. Arriving at the shop nobody there spoke either German or English but it was not too difficult to explain that we needed three 5mm holes drilled and 5 minutes later we were on our way, dish drilled.

We found an ideal place near Auderville, directly at the ocean with the required clear shot to the west. This was also a historic site, where in 1940 British reconnaissance aircraft for the first time detected the German Freya, in today's terms an early warning radar. The concrete foundation and a number of bunkers are still visible.

At 1700 local there was total calm, but after dark a strong storm came up making it extremely difficult to hold the dish in position. I made one QSO (05OCT01, 2000 UTC) with N7UX/P in DM43, and then gave up.

After the stormy night on the La Hague peninsula, the northernmost part of Normandy, we reached La Pernelle on Saturday after-

DK2ZF with his AO-40 antennas next to the Wuerzburg Giant, La Delivandre, France.

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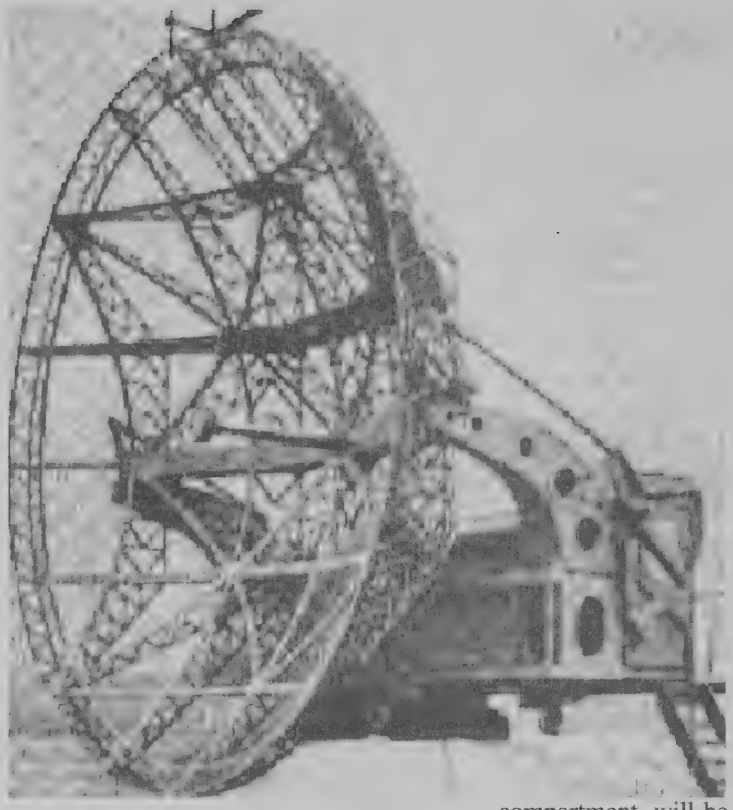

**The Wuerzburg Giant, a 25m dish at 500MHz. (A potenital AO-40 70cm uplink?)**

noon. A German radio navigation system called *Bernhard* was located there until 1945. The circular foundation with more than 30 ft in diameter can still be easily recognized.

Prior to working AO-40, a few stations were worked SSB in the European UHF Contest on 432 MHz. Here again the SYLEDIS *toc toc toc* was interfering. Then on 06OCT01 between 1842 and 2054 UTC, I worked W1BFN and also W4O, the special event station of the AMSAT Symposium in Atlanta. However, the highlight of the evening was hearing a CQ call in Spanish by LU2DDU on the unusual low frequency of 2401.261 MHz. I called him but unfortunately, he didn't come back

On the way back to Germany and with the Jones book in hand we stopped at the cliffs of Bruneval in search of the site of the German Wuerzburg equipment. However, the many bulls on the surrounding pasture made us retreat prematurely. In the evening we stopped again at the lighthouse at Cape Antifer where this time it was perfectly calm accompanied by a dreamlike sunset. But the noise level of S6 was still there. Some more checking revealed it came directly from the lighthouse. So we left to look for a better location but got lost completely. No AO-40 that night!

The next evening saw us with the motor home at Douvres La Delivandre, the museum of the Wuerzburg Giant. This early radar used a dish of 25 ft in diameter at a frequency of 500 MHz. With this dish an uplink power at 70cm of a few hundred mW would have been plenty.

This night, spent mostly in the unheated driver's compartment, will be hard to forget for F/DK2ZF. The transponder came on only for one minute at MA 87, and then RUDAK took over. For the next two hours, between 0100 and 0300 local, only Boeing signals could be heard. They are called that because the signals are coming back on "737." When the transponder came on again, there were practically no W station still active. Another lost night!!!

Our last *AO-40 stop* on the way home was near the Dutch city of Appeldoorn at an Autobahn rest stop. By this time, between the XYL and myself, it took only 15 minutes to set up the satellite station. With 40W and the 2 ft dish I made many contacts.

As a result of this trip the equipment selection for the 2002 10-country Pacific expedition is easy. In comparison to the April 2001 Seychelles Expedition (S79RN) where the equipment weighed in at 136 lbs, this time it will only be 90 lbs. CU on AO-40 from the Pacific, however, only with split frequency operations. ■

# To Mars with Phase 5A! Part 2

**Karl Meinzer, DJ4ZC**

***Translation by John J. Bubbers, W1GYD***

*The first part of this article that appeared in the November/December 2001 issue of The AMSAT Journal showed that a space vehicle of the Phase 3D design could be modified so that a flight into an orbital path to Mars was possible. In this part, we will examine the details in real terms of how the spacecraft has to be modified to be suitable for such a mission.*

In the first part I showed that two characteristics extensively influence the satellite design:

- The propulsion capacity of the satellite has to amount to about 2.5 km/s in order to be able to reach the necessary orbits.

- The radio paths are quite difficult, consequently an antenna with a diameter of about 2 m on the space vehicle is necessary. This also has consequences, naturally, on the attitude control.

### The Propulsion Requirement

The necessary propulsion performance is needed for the most part at two places: during the departure from the Earth's orbit and during entering into the Mars orbit. These maneuvers have to be carried out during perigee in elliptical orbital paths, and there is only a very short time period available. This means that only chemical propulsion can deliver the required thrust. The need then follows to plan for the same 400-N propulsion system that has already been flown on Phase 3 satellites several times.

The satellite's driving power, Vs, results from the propulsion system's characteristics (Isp, which is the effective exit velocity of the rocket motor, also called the specific impulse) and from the relationship of the mass of the fuel (mf) to the satellite's unloaded mass (md).

$$Vs = Isp * \ln((mf+md)/md) \quad [1]$$

For the purposes of planning, a drive requirement of 2.5 km/s is assumed; the precise value (including the reserves for navigation inaccuracies) depends on the launch year and the details of the maneuvering guidance. Currently there are studies to determine the necessary range; after that the necessary value might be increased by up to 20% or reduced by up to 10%. The 400-N engine has an Isp of 3.03 km/s. According to formula [1] the range of fuel mass and unloaded mass (dry mass) are fixed, if one inserts a maximum take-off weight of 650 kg as in the case of AO-40.

Take-off weight mf + md = 650 kg, Isp = 3.03 km/s:

| Drive Performance Vs | Dry md | Fuel Weight mf |
|---|---|---|
| 2.25 km/s | 309.3 kg | 340.7 kg |
| 2.50 km/s | 284.8 kg | 365.2 kg |
| 3.00 km/s | 241.5 kg | 408.5 kg |

The 400-N propulsion system uses MON1 ($N_2O_4$) as an oxidizer and MMH as fuel. The density of MON1 is 1.445 g/cm$^3$, and that of

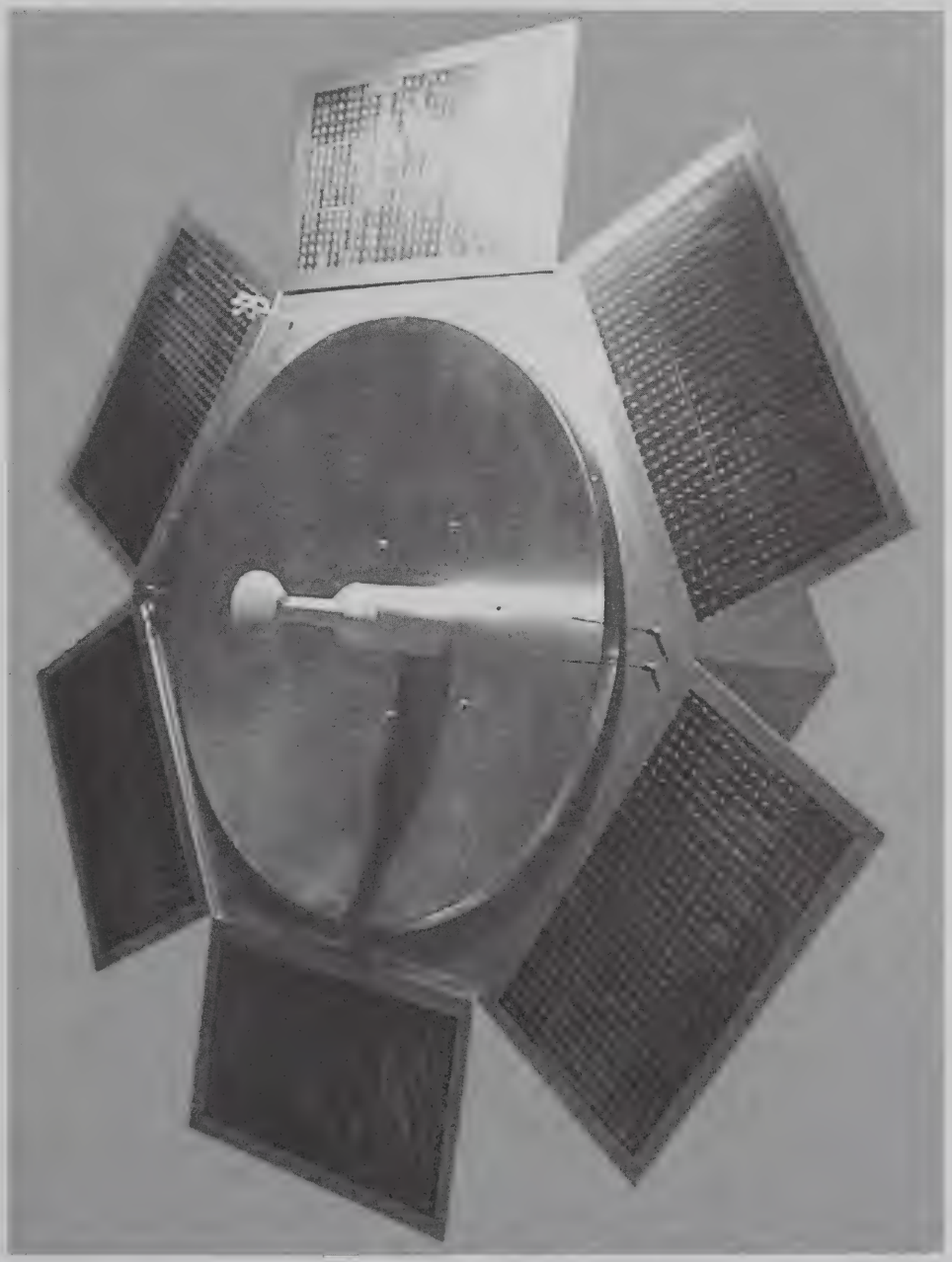

**Figure 1. Possible depiction of AMSAT-DL Phase 5A Mars spacecraft.**

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MMH is 0.8788 g/cm$^3$. The ratio of the densities is 1.665. For that reason the engine has been adjusted accordingly, so that exactly this ratio is needed for the necessary mixing ratio between oxidizer and fuel; with this, large tanks can be used for both of these materials.

Taking both propulsion materials together gives an average density of 1.1619; for the above fuel quantities tanks for a total of 294, 315 and 352 liters are necessary. AO-40 has six tanks each 49 liters (294 1 total), which means that those tanks would only be adequate to achieve 2.5 km/s in that case. It is therefore reasonable to plan for larger tanks to deal with difficult propulsion situations. Moreover, the tanks were specially fabricated in Russia; currently it is not clear whether more tanks can be obtained from this source. In any event it must also be checked whether still larger tanks can be built in, so that four rather than six tanks are adequate. The freed-up volume could then be used for sub-satellites (see below).

From the figures it is clear that the mass of the fuel and the resultant volume for the tanks is a very important element in the design of the satellite.

**The Antenna and the Satellite's Performance**

The Phase 3D structure's diameter permits the use of the upper face of the satellite for a parabolic antenna with an approximate diameter of 2 meters. The design will be influenced primarily to keep the structural height of the satellite as low as possible in order to use the already available SBS structure (Figure 2). The SBS is in flight-ready, qualified condition, as it was at the launch of AO-40; a new flight qualification would be required for any changes, which is associated with appreciable effort and cost.

Above all, one would want a flat form for the antenna, since then the least amount of the satellite's area is lost using a concave format. A parabolic antenna becomes flatter as the focal length becomes larger. However, then the feed system is located a greater distance from the reflector, so that the total height of the satellite then becomes greater. An improvement can be achieved by using a hyperbolic secondary reflector (Cassegrain-antenna). This reflector is arranged between the focal point and the main antenna, by which a shortening of the overall construction shape is possible, although one has to accept the shadow of the of the auxiliary reflector in the bargain.

Aside from these basic considerations a very practical question has to be cleared up, namely how to fabricate the antenna with its flat surface format. One could, for instance, install a commercial antenna made of aluminum into the satellite that forms a part of the upper surface of the antenna. In this case, the internal vertical walls of the satellite must be shaped so that they can be riveted to the antenna. With this solution one is committed to commercially available antennas. It would be a coincidence if one could buy an antenna with the required diameter and the necessary focal length, which is also especially light.

Alternatively, one could shape the antenna out of sheet metal segments. Then the main problem is how to create the necessary form. The same problem presents itself in forming the auxiliary reflector, although a structure could be made out of moldable material (fiberglass, for instance). The construction of the antenna presents a requirement, which needs special attention, in any event.

An antenna with a 2-m diameter has a beamwidth of about 1° at 10.5 GHz; this means that the space vehicle must be aimed at the Earth to an accuracy of about 0.1° in order to use this antenna. At this point I won't discuss how to achieve this degree of accuracy on the satellite nor how to suitably control it. I would rather like to review the more basic question, what consequences this performance has for the other operation of the satellite. For these considerations it is really important whether to spin-stabilize or three-axis stabilize the satellite for the necessary alignment.

From the orbit geometry in (see Figure 2 of Part 1 article) one can assume that the relative alignment between the space vehicle and the Earth will not change materially in space during the flight time to Mars. In actuality we will use this characteristic from the current generation (see more below). Practically, gyroscopes will stabilize the attitude of the satellite, in that, either the complete satellite is set into rotation, or reaction wheels are set into motion. The attitude is thereby fixed in absolute space. The orbit is, however, around the sun, and thereby the direction to Earth changes. The attitude of the satellite,

therefore, has to be corrected daily by approximately 1°.

This is quite unwelcome on a reaction wheel stabilized satellite; for a directional accuracy of 0.1° approximately 10 daily corrections are required. Since there is no magnetic field between the Earth and Mars, it means that there has to be a small gas jet thrust.

A reaction wheel stabilization of the entire satellite is less attractive because of this fact, as one would have assumed. On the other hand AMSAT has reaction wheels available on Phase 3D, which can be engaged for its mission. Using this type of attitude control there is always an axis (the direction of the sums of the turning impulse of the wheels) about which the stabilization is quite unstable and must therefore be controlled continuously. Considering the Mars mission geometry this axis would be perpendicular to the ecliptic and make a benefit out of the need: the active control would then function in the East/West direction and simultaneously intercept the daily geometric changes without having to expend any mass. In this case linear polarization could be used for the communications paths; this would simplify the ground installations.

A very large advantage of the three-axis control would be the ability to easily realize different orientations of the space vehicle for temporary experiments on Mars. The disadvantages of these concepts are that the three-axis control is mainly susceptible to interference and heavier and during the 400-N engine driving phase apparently cannot forgo the spin stabilization. The problem of the spin stabilization cannot be completely avoided as a result (especially during the transition in this mode).

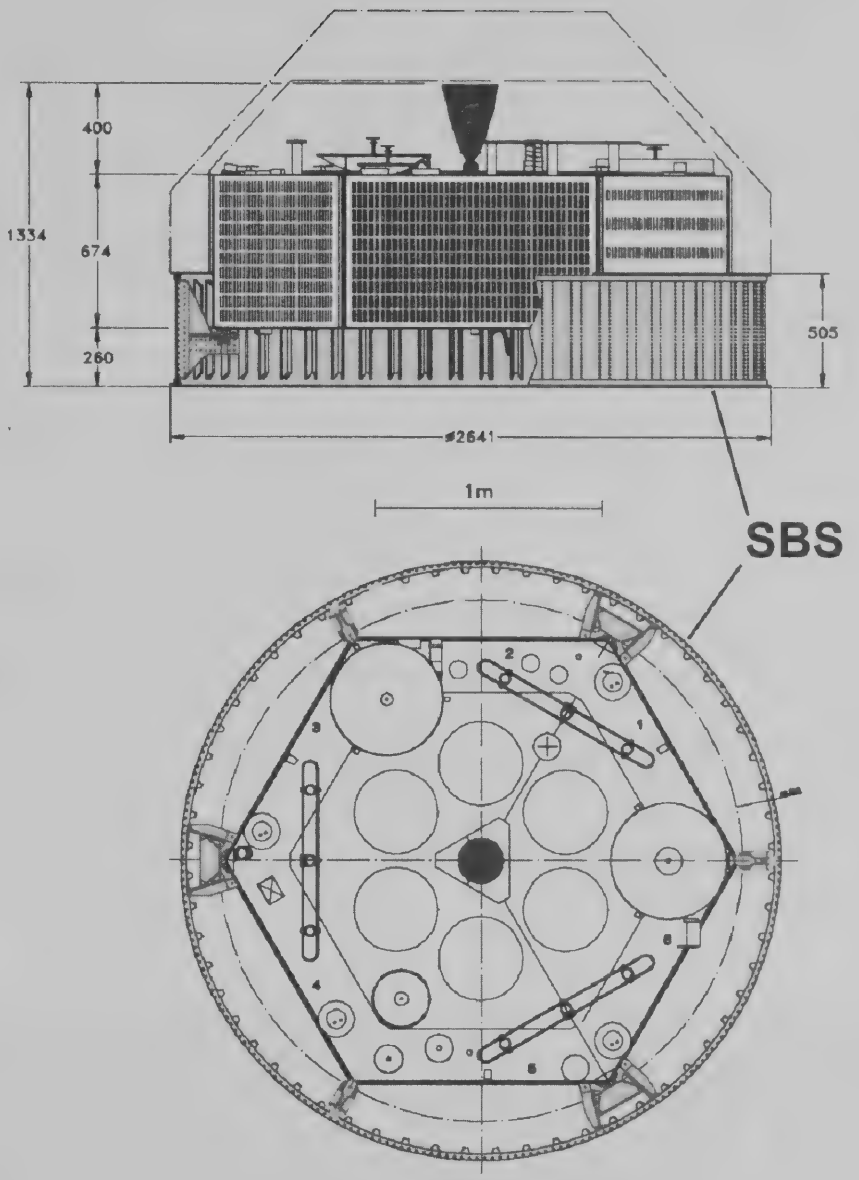


**Figure 2. Phase 3D inserted in Static Bearing Structure (SBS). Use of the SBS is also proposed for a Phase 5A spacecraft.**

### Current Generation and Thermal Relationship

The radio links require that the orientation of the satellite's antenna be toward the Earth most of the time as well as during the flight to Mars and in its orbit. The geometry is thereby determined by its relationship to the sun. Since the orbital path is outside of the Earth's orbital path, most of the time the direction to the sun never deviates more than 45° from the direction of the Earth. This lets the solar generator look in the same direction as the Earth, and avoids a separate orientation of the generator. This is naturally associated with a loss like on AO-40; ideally the sun would look down perpendicularly on the generator. But the expense of a steering control can be avoided by displaying a somewhat larger generator and thereby produce the same amount of current.

(Figure 1 shows a possible depiction of this concept: during the launch six panels are located parallel to the six exterior walls of the satellite and thereby take up no room. After the launch these six panels will be swung upward and thus look in the same direction as the parabolic antenna.

The solar constant in Earth orbit amounts to 1.4 kW/m$^2$, but is reduced to 0.6 kW/m$^2$ going to Mars. However, this does not mean that only 40% of the current from the solar generator is received, because simultaneously the solar generator's temperature is reduced. The efficiency is thereby increased, and 50 – 60% of the electrical output can be expected.

If there is a panel equal to the size of that on AO-40, there is a total area of 3.78 m$^2$ available. At a surface efficiency of 10% (including battery losses, overall) it means that in the Earth's orbit with perpendicular illumination there is 500 W available and with an illumination deviation of 60°, 250 W is available. On Mars the available power would be

greater than 250W or 125W. For the time being the presentations would just be adequate for the operation including a 50W transmitter.

Managing the temperature of the space vehicle is more difficult because of the reduced sun's radiation in orbit around Mars. The temperature of the space vehicle represents a balance between the radiated power (infra-red) and the incoming radiation from the sun (light). The power from the sun depends only on the distance from the sun, not on the temperature of the space vehicle. In comparison, the infra-red radiation is a function of the temperature and follows the Stefan-Boltzmann law:

$P(\text{radiated}) = e * A * \text{Sigma} * T^4$ where:

- E = Infra-red emission coefficient of the area (about 10 micro-m)
- A = Area of the Satellite
- Sigma $= 5.67*10^{-8}$ W $m^{-2}$ $K^{-4}$
- T = Absolute temperature in Kelvin

By selecting *a* (the absorption coefficient for visible light of the surface) and *e* more or less any desired temperature of the space vehicle can be set in constant sunshine. Unfortunately, the incoming sunshine changes very considerably from the Earth's orbit to the Mars orbit, and consequently the temperature of the satellite changes. If the temperature in Earth's orbit is set at 40°C, for instance, the temperature at the Mars orbit will drop to -20°C.

This range is too great to be useful in operation. Arrangements must be made which change either the surface characteristics or its geometry so the temperature remains more or less constant.

There are several methods for this. For instance, screening films can be provided on the surface that greatly reduce the Sun's incoming radiation in the Earth's orbit and then can be discarded while in transit. Dedicated mechanical arrangements can be provided which thermostatically (bi-metal) expose the visible surface in smaller or larger zones and thereby regulate the temperature. Heat pipes were also discussed which operate with gas ballast and would become inactive below a certain temperature. In the course of developing such a space vehicle it will have to be made clear which of these methods or which combinations are simplest and most reliable, and which are best suited for this mission. It would be adequate if one could elevate the temperature by 30°C in a one-time event, for example, since during the flight to Mars the temperature is constantly being reduced and then remains constant. It is certain that during the complete development phase of the satellite the temperature situation must be kept in mind, since it represents a central problem for such a mission.

**Figure 3. Artist's conception of a possible Mars Society sub-satellite employed by Phase 5A.**

### Further Particulars of the Mission

Aside from the discussed problems there are several particulars of the basic mission that must also be carefully thought through. In comparison to Phase 3D they are mainly:

#### Navigation

The space vehicle must be guided accurately to within a few hundred kilometers of Mars, so that entry into the Mars orbit becomes feasible. Currently it not clear how it can best be implemented, since AMSAT has neither the experience nor the ground equipment available, which, for instance, NASA has. Of course, sufficient precise location determinations are possible from distance measurements so the problem appears to be soluable. In the vicinity of Mars an optical camera can additionally be used.

#### Attitude Determination

On Phase 3D/AO-40 optical sun and Earth sensors are used. For the flight to Mars the Sun can also be used for a further direction reference determination. Above and beyond, a further direction determination is required, which probably makes a star sensor necessary. In the past a bright star (Canopus) has often been used which is not far from the South Pole of the sky and thereby permits an orientation in reference to the ecliptic.

#### Attitude Control

Independently of whether to use reaction wheels or reaction stabilization is the need for attitude control, with which to produce torques on the spacecraft. In the past we used the Earth's magnetic field for this. In interplanetary space there is no sufficiently strong field so that a small rocket jet is indicated, which naturally needs expendable material (fuel). The necessary anticipated total turning force, which is required for the execution of the mission, must therefore be carefully estimated during the planning of this subsystem. A part of the needed turning force can possibly be generated by pres-

sure of light, a technique that has been used once before.

**Communication System**

One of the assignments of Phase 5A should be that other payloads should send their communications to Phase 5A from the ground surface of Mars, for instance. Our satellite would then relay the data to Earth, which could then be received by radio amateurs, evaluated accordingly and then eventually relayed and made generally accessible. This precludes that not only the radio technology has to be supported, but also that Phase 5A is fully conversant with the communication formats as they are set up by ESA or NASA, for example. Actually the necessary technology for the RUDAK payloads is already generally available, since the communication formats can be produced by suitable software for the most part.

**Sub-Satellites**

Several suggestions have come to AMSAT, which anticipate that Phase 5A will take along several sub-satellites to Mars. These subsatellites would be separated in Mars orbit and perform specialized tasks. I would like to illustrate two of them here in greater detail.

One of the main questions in Mars research is where the water has gone, about which it is fairly certain, that it existed on Mars during an earlier time. Today we don't know whether there are large quantities of water available in the ground or whether the water has totally disappeared. This question doesn't have a great meaning just for planetary physics. If water is now still accessible, it would make human exploration of Mars much easier; water can be used to generate breathable oxygen as well as for the production of rocket fuel to be used for the return flight.

If water is still in the ground at several locations, specific humidity will be measurable at these locations. There is a technique that has already been used called *radio occultation*. If two satellites are in contact with each other, the propagation time of the radio radiation can be measured relatively easily. If the radio signal propagates through the Mars atmosphere, the radio wave is slowed down when passing through a volume of gas (exactly like the light velocity which is lower in gas than in a vacuum). With two satellites in different orbits there is always the situation in which Mars breaks into the radio waves between the two and interrupts the connection. Before this event takes place the radio signal passes through ever increasing layers of the atmosphere, until it finally reaches the ground and is in the shadow. If the propagation time is measured during this process, an exact profile of the atmosphere at that point can be made at which the radio wave touches the Mars ground. Thereby the water content results in a clearly measurable effect. With multiple satellites this process naturally occurs more frequently, in which many processes are observed, and from many observation points on Mars so there is an indication of the water content. From these points a rough map of Mars with its water deposits can be generated.

These measurements are technically very easy to perform; only sub-satellites with coherent transponders are needed, which can be built at little expense. The necessary subsatellites can be very small, for instance, cubes with an edge length of 10 cm (so-called picosats), are especially well suited to be carried along on a mission such as Phase 5A.

We received a further suggestion from the German Mars Society. In this case a somewhat larger sub-satellite would be carried along. This satellite should be ejected in Mars's orbit. After the separation and at the right location a small solid propellant rocket would be ignited that provides for having the satellite enter the Mars atmosphere. A heat shield would decelerate the satellite, and at about 10 km altitude a balloon would unfold and be inflated. This balloon will then fly around Mars multiple times on the high velocity winds and send pictures and other data made on the flight to Phase 5A (Figure 3).

This brief description shows that this project is technically more demanding and difficult than the radio occultation satellites. Further work must indicate whether this project is feasible, and whether it is compatible with the technical parameters of Phase 5A.

**How to Proceed?**

Meanwhile, several studies have been started to clarify the addressed technical questions and to definitively work out the demands resulting from the satellite design requirements. It should be considered that in about the next six months a reference design will be generated that could then serve as a basis for the Phase 5A project.

Simultaneously it will become clear which persons and which organizations want to collaborate on this mission. Closely associated with this is also the question of what organizations would finance such a project; it is clear that Amateur Radio and the AMSAT members can't pay for such a project. Depending on these results and the corresponding interest of the members, AMSAT-DL will then have to decide how much importance the Phase 5A satellite will have to the future of AMSAT-DL.

It is already apparent that Phase 5A presents an interesting challenge for a large number of young people, and that AMSAT-DL can count on a large increase of highly motivated people and new talent with this project. Communication technology and Amateur Radio's position of importance in the community have changed greatly in the past ten years. Planetary space beyond the Earth's orbit is perhaps exactly the demand that AMSAT needs to be on its way to the cutting edge of the future for technological development and space travel. ■


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# Report of the AMSAT Board of Director's Meeting
## Held October 7 and 8, 2001 in Decatur, Georgia

*W3XO's Comments: The following should not be construed as minutes as such. Rather it is a report of the discussions and decisions reached at the AMSAT-NA Board of Directors meeting held in Decatur, GA in October 2001. I have attempted to, as accurately as possible, reproduce faithfully all that occurred during the open sessions, which comprised most of the meeting. In order to assure that various participants have been quoted accurately, I sent advanced drafts to all participants, not merely Board members. Several corrections were received and were incorporated into the final product. The reason it was possible to reproduce the discussions in such detail is because we employ a tape recorder during the sessions. The tapes are then transcribed by Bill Hook, W3QBC and sent to me for final editing. Without Bill's fine work in accomplishing this arduous and exacting task, such detailed reports to the membership would not be possible.*

*Note that two sections have been included without any editing. They are the President's Report and the MOST Report submitted by Dr. Rob Zee of the University of Toronto.*

*Although we would prefer that all AMSAT Board session be open to all of our members, we were forced to hold two closed secessions. One concerned some rather restrictive U.S. Government regulations with which we must deal. An approach which may offer some potential for help for us in this regard was developed during that session. The other closed session dealt with the performance and compensation of our sole employee, Martha Sargovitz.*

*You might think it strange, in reading this report, that so many votes were unanimous. The reason this is so often the case is the amount of time we spend in discussing the various issues that come before the Board. Usually, by the time the discussion is concluded and everyone has had his or her say, a consensus has been reached. So, the vote is merely a reflection of that consensus.*

A meeting of the AMSAT Board of Directors (BoD) was convened by Chairman Bill Tynan at 1035 EDT on Sunday, 7 October 2001 at the Holiday Inn Select in Decatur, Georgia.

Members of the Board of Directors (BoD) in attendance were:

- Barry Baines, WD4ASW
- Keith Baker, KB1SF
- Tom Clark, W3IWI
- Dick Daniels, W4PUJ
- Robin Haighton, VE3FRH
- Andy MacAllister, W5ACM
- Bill Tynan, W3XO
- Bruce Paige, KK5DO - First Alternate
- Rick Hambly, W2GPS - Second Alternate

Others participating or observing at various times included:

- Frank Bauer, KA3HDO - VP, Human Space Flight Programs
- Larry Brown, W7LB - Area Coordinator
- Bill Burden, WB1BRE - VP, Strategic Planning
- Ken Chaffee, WA1QXR - Area Coordinator
- Martin Davidoff, K2UBC - Author, *Satellite Experimenter's Handbook*
- Art Feller, W4ART - Treasurer
- Dick Jansson, WD4FAB - AO-40 Thermal & Mechanical Design
- Lyle Johnson, KK7P - AO-40 IHU & RUDAK Director
- Phil Karn, KA9Q - Software Development, Coding & Modulation
- Jan King, W3GEY - Past VP, Engineering
- Nick Lauerman, KB9WWS - Member Observer
- Roger Ley, WA9PZL - Area Coordinator
- Lou McFadin, W5DID - Orlando Lab Manager
- Keith Pugh, W5IU - VP, Operations
- Martha Saragovitz - Corporate Secretary
- Shep Shepard, AA7MH - VP, Development
- John Shew, N4QQ - Member Observer
- Paul Shuch, N6TX - Executive Director, The SETI League Member Observer
- Ray Soifer, W2RS - VP, International Affairs
- Russ Tillman, K5NRK - VP, Publications and Journal Editor
- Paul Williamson, KB5MU - VP, Electronic Publications
- Harry Yoneda, JA1ANG - Satellite Editor, CQ Ham Radio (Japan) Member Observer
- Stan Wood, WA4NFY - VP, Engineering

The following Board members also hold the offices indicated;

- Barry Baines, WD4ASW - VP, Field Operations
- Keith Baker, KB1SF - Immediate Past President
- Tom Clark, W3IWI - President Emeritus
- Robin Haighton, VE3FRH - President & Canadian Liaison
- Andy MacAllister, W5ACM - VP, User Services
- Bill Tynan, W3XO - Chairman of the Board

### I. Election and Appointment of Officers

After welcoming Board members and guests, Chairman Tynan began the meeting by calling for nominations of officers. Tom Clark nominated Robin Haighton for President and moved that the nominations be closed. The motion passed and Haighton was declared reelected as President. Haighton stated that younger people are needed to fill the offices and expressed the hope that the next person to hold his office would have a more contemporary and innovative outlook. He added that the President must dedicate many hours each day to serving AMSAT and that each Board member should have a plan to find their successor.

Ray Soifer announced that he will not stand for reelection as Executive VP because of demands of his professional consulting practice but is willing to continue serving as VP for International Affairs. Haighton stated that he has attempted to find a person to serve as Executive Vice President and has thus far been unsuccessful. He proposed that while the search continues 1) he hold both positions of President and Executive VP, 2) that specific Board members be asked to carry out certain Executive VP functions and 3) in his absence a Board member be appointed to serve as acting President. Clark recommended that the office of Executive VP be declared vacant rather that Haighton holding both offices. General agreement was expressed citing the precedent that the person serving as Executive VP is considered to be the successor to the sitting president. Haighton agreed to the recommendation and because no nominations were received for the title of Executive VP, he declared this office to be vacant.

The other offices to be filled were next considered. Haighton nominated Martha Saragovitz to continue to serve as Corporate Secretary, Tynan seconded and Martha was reelected by acclimation. Haighton then nominated Art Feller to continue as Treasurer, Baker provided a second and he was reelected by unanimous vote. Tynan noted Feller's long an excellent service to AMSAT. Clark nominated Stan Wood to continue as VP for Engineering. Haighton seconded and Wood's nomination was unanimously approved. Keith Pugh announced that he would agree to serve as VP for Operations. Thereupon, he was nominated by Tynan with Haighton providing the second. Pugh was then reelected by a unanimous vote. Haighton nominated Saragovitz to continue as Manager and Tynan seconded. A unanimous vote reelected Martha to this office. Haighton nominated Tynan as Chariman of the Board. A second was provided by Baker and the vote was unanimously in favor with the exception of Tynan who abstained. Other officers, not required by the By Laws, are to be appointed by the President with no Board action required.

### II. Presentation of the Budget for 2002

Feller provided copies of a draft of the Budget, explained how it was derived and asked for questions. Tynan reminded the Board that the policy has been to discuss each item as the department reports, so that they can be asked for information about possible additions and subtractions. At the end of the meeting this information is consolidated and, if possible, a vote taken to approve the budget.

Clark reported that a question at the previous day's public session asked if we still have a deficit from the AO-40 project, to which Haighton had replied that, while there was a deficit in terms of what was expended on the project and the funds raised for it, other income had essentially made up for the shortfall. Clark said he was surprised to hear this and asked if indeed we had no accumulated deficit and the status of our financial reserves? Keith Baker responded that the reserves amounted to approximately $500,000. He then provided a summary of Phase 3D (AO-40) finances through December 2000. He reported that over the entire period AMSAT-NA itself raised $1,181,280 an additional $528,703 was contributed by ARRL and $113,659 by AMSAT-UK. There was a $50,000 donation from JAMSAT and AMSAT-DL provided $117,812 for a total of $1,991,456. He summarized expenses as follows: $411,898 for components, contracts

amounting to $896,325, communications $77,544, $244,847 for travel and everything else amounted to $459,877, plus in 1995 we sent a $210,592 payment toward launch costs for a total of $2,301,083. This resulted in a deficit of $309,627.

Haighton noted, however, that, as a result of other income received, AMSAT's Fund Balance had not been significantly reduced by the Phase 3D effort.

Baker explained that Haighton's remark was based on income we received from the MOST project and that this just about offsets that loss. Clark replied that indeed this was one way to look at it but he preferred to regard it as a $309,000 deficit. He then presented the case for announcing to the membership that we are in the red from AO-40 and opined that it would not be bad policy to make that fact known.

Haighton said that, while he agreed, he would like to retire the debt on AO-40, citing the amount received for our work on MOST and other projects. He added that our biggest problem is now finding money for future programs. Clark opined that a better way to put it was that we have already started on the new projects and that we have about $300,000 from MOST to fund them.

Tynan noted that our Fund Balance is higher, not lower after finishing with AO-40 than it was before we began in the early 1990s. Baker noted, however that if you include inflation, the increase is not as great as it might appear.

Haighton congratulated and thanked the AMSAT volunteers who worked on MOST for doing, without exception, a superb job and he added that without them we would not have have raised the money that has been critical to maintaining our fund balance. Haighton also said that he has encouraged these volunteers to continue the relationship with the MOST project. He followed with a motion that the MOST volunteers be profusely thanked for their excellent efforts. Clark seconded and the motion was passed by a unanimous vote.

With regard to closeout expenses, Daniels expressed surprise at the large amount Stacy Mills, W4SM had spent for telephone calls and asked if we are covering these continuing costs. Saragovitz replied that Mills has not sought reimbursement for this. Daniels suggested that we arrange to compensate him for these expenses and Saragovitz agreed to do so. Dick Jansson stated that he has a few uncompensated expenses for AO-40. Tynan noted that the Budget has an Operations Department item to cover these.

Clark asked about the status in the Budget of the planned "JJ" project in view of the substantial and earmarked contribution from Phil Karn for a project involving digital modulation. He then asked where the Karn project appears in the Budget? Saragovitz replied that it was listed in Department 12, Earth Station Project. Tynan noted that could be considered appropriate as it had been perceived that the ground equipment is the major technical hurdle in achieving what Phil has proposed. Clark reminded the board that at the February Board meeting held in Orlando, Karn and others were encouraged to begin development of this program as quickly as possible and possibly to hold an organizational meeting. He said this item should appear in the budget. Tynan added that his original interpretation was that Karn's project was to be included with JJ. However, he noted, recent technological findings have suggested that it may be necessary to rethink that concept. Clark stated that the Treasurer has not interpreted it this way and he wondered if this high priority item has been dropped from among those having a numerical accounting code. Saragovitz repeated that it is now in Department 12 and when financial estimates are received from Karn it will be added to the Budget. Clark then asked that the name be changed to indicate that the task has to do with an integrated spacecraft and ground station user terminal. Saragovitz said this could easily be done and added that estimates of expenses were needed first and suggested that Karn may not have been among those who received the message asking for budget estimates for next year. Tynan again expressed his agreement with Clark's observations and declared that if the digital project were not to be part of the JJ undertaking, then we need to clearly identify it. The Board wants to support the Karn digital project, so the project leader needs to provide an estimate of how much money is needed before it can be allocated. Karn remarked that the donation he made last year is earmarked primarily because he wants to promote the development of digital communications technology within AMSAT. He explained that in the past the bottlenecks have not been with the spacecraft, but in the ground station segment, and that's why he wanted the money to primarily go toward the development of ground terminal equipment, but should not be restricted to that. He agreed that, however, development of the ground station equipment is the biggest part of the problem so his donation was intended to provide seed money for this. He said that, so far, the interested parties have just been communicating without incurring any real expenses. When the building process begins there will be expenses and he thought they had already been allocated at the last Board meeting. Haighton declared that we still need to know what expenses are expected and Karn replied that he would prepare an itemized list. Daniels asserted that it is to our advantage to have more than one development project underway and Tynan agreed. Haighton concluded the budget discussion saying that after consulting with VP for Education Liaison Steve Bible it was decided that $5,000 should be allocated for this department under Department 14.

### III. Projects Committee Report

Lyle Johnson reported on two projects, a new on-board computer (IHU) and the planned high altitude JJ satellite. First, noting that the improved on-board IHU project was approved and allocated $5,000 at the February BoD meeting, he said that approximately $3,700 had been spent to date and it was expected that they might wind up a few hundred dollars short. The circuit board for the computer has been completed by Chuck Green and is ready for testing and final development of the actual device. Johnson acknowledged his co-workers who include in addition to Green, Karl Meinzer, Peter Guzelow, James Miller, Bdale Garbee, Stacy Mills and Paul Willmott. AMSAT-DL has agreed to also support this effort so there may be an opportunity for additional funding from that source.

Johnson stated that with regard to funding the new JJ satellite, the budget estimate developed with Feller's help was based on historical patterns of spending. Other than launch costs, the estimated amount is $600,000 with $220,000 budgeted for next year. The satellite's final configuration is yet to be defined and depends on the launch opportunity. Johnson said that he was encouraged that Larry Kayser is assisting with solar panel design and fabrication and may find ways to significantly reduce the cost of the panels. These developments may be of use to other satellite projects as well, so there is a possibility of deriving some income for AMSAT from them. There are general planning and requirement documents that need to be created and it is anticipated that a launch opportunity will be identified in December. In January of 2002 there should be a design review that will generate some expenses. This will include defining power requirements, presenting a block diagram, mechanical issues, test planning, integration requirements and possibly ordering of parts. A critical design review will likely be held mid-2002 where things will be examined at the schematic diagram level as well as detailed design documents, testing and integration requirements plus defining what special equipment will be needed. It was stated that Steve Diggs has offered to help with testing and quality control issues. Johnson said that significant amounts of money are not expected to be needed until after the middle of next year, and estimated early expenditures to be in the order of $20,000-$30,000. After the Critical Design Review and approvals are given to build the modules, it will then be necessary to spend significantly more for actual construction. In 2003, the integration is to begin. Budgeting for that phase should be considered by the Board at the time of next year's Annual Meeting.

Daniels asked if it would not be advantageous to purchase solar cells ahead of schedule if they can be had at favorable prices? Johnson replied that Kayser will first want a few thousand dollars to purchase cells to clarify mechanical issues, but that advance purchase had not been considered. Haighton announced that a fund raising effort has already begun in Canada in support of the solar cell part of the project and that Saragovitz is keeping records of these funds. Johnson explained that money allocated within this project for the Karn digital system are only for the design and construction of the space portion. He said he considered ground station development in support of the digital project as a separate activity.

Tynan urged the team to develop a defined interface document, maintaining that it is important when various sub-systems are being developed by different groups at various locations to be certain interfaces are well defined and understood by all participants.

McFadin asked where the integration would be done, to which Johnson replied that Orlando is the most likely location. McFadin responded saying that, if that is the case, provisions should be made to maintain the lab there in coming years. He added that costs running the facility are presently being charged to the Human Space Flight (ARISS) project and suggested that some of these expenses be charged to the JJ project. Saragovitz asked if the JJ project will be using the Orlando facility in 2002 or 2003 and Johnson replied that it was likely there will be some of this activity there in the latter part of 2002. She said the office would make the necessary budget arrangements at the appropriate time.

Haighton asked to see a preliminary schedule of Milestones made available on the AMSAT Web site and indicated it should be periodically updated.

Tynan inquired if the Projects Committee should be directing the digital project and other future ongoing projects? Daniels asked if after one of these projects gets underway, a separate group should be formed, rather than leaving it to the Project Committee? Haighton replied in the affirmative agreeing that we should not have one group trying to do too many things. Tynan agreed that when you get to actual designing you should have separate groups, although there very well be some overlap in membership.

Daniels reminded the Board that in the past we have had to face necessities imposed by launch and time requirements and have often had to come up with something less complex than we originally planned. He urged that the planners provide as much flexibility as possible by designing small modules. If things are sized to fit only the proposed JJ spacecraft, then we would be obliged to build a satellite of that size in order to accommodate them. And, we may not be able to get a launch for such a spacecraft.

Clark responded to a recent posting by Karn saying that it looked like the digital initiative was better suited for a LEO mission but the Projects Committee had apparently decided that a GTO spacecraft was the only project presently under consideration. Clark said he had sent a reply stating his opinion that this was not quite what had been agreed upon. Objections to his reply were received from some members of the Projects Committee, to which Clark had responded that in his recollection the Board did not give the Projects Committee any direction that a GTO program was the only thing to be considered. He mentioned that there are other missions, such as the Cubesats, that might be creatively used to fill AMSAT's goals. A vigorous discussion followed concerning the role of the Projects Committee, their mandate and the areas appropriate for their decision-making. It was evident that those present had conflicting interpretations of the intended function of the Committee. The fundamental uncertainty involved whether the Projects Committee was established to design the JJ satellite or to evaluate new projects which might be presented for AMSAT's consideration. Haighton responded that, while the Committee was originally conceived to advise the Board on new ideas for projects, it has evolved to include project planning. This was due in part, he said, because no new ideas for projects had been submitted. Johnson recommended that a separate committee be set up for the JJ participants with an independent e-mail reflector and opined that the Projects Committee should maintain their efforts to evaluate proposed new projects.

Daniels expressed the opinion that if the JJ satellite design is at the level of complexity and cost presently conceived, we should not assume that we can support any other projects because it will consume all our technical talent unless additional workers are recruited. Tynan announced that he wanted the digital project to go forward and if it's decided that a vehicle in GTO is not the appropriate space segment for it we will have to consider a different approach. Karn replied that because of our limited resources it was deemed impractical to have two different projects going forward at once and added that we have seen how expensive and complex high orbit satellites are so we need to go back to building small, low orbit spacecraft. Tynan expressed the opinion that the Board does not want to make an *either/or* decision on this now; to which Haighton agreed, saying there may be a solution forthcoming to satisfy the need of Karn's digital project. The discussion continued at length with several others providing opinions and recommendations.

Tynan noted that hams want things they are familiar with and added that he had received many critical comments regarding AMSAT's apparent plan to build a digital-only spacecraft. He added that, although he considers this opinion wrong, it is nevertheless prevalent and must be considered. He agreed with Karn that if we can demonstrate how good the digital approach would perform, perhaps it would then be readily accepted. Paige made the analogy that in the past the majority of amateurs preferred CW over voice, but now with newer hams and a no-code license that situation is reversed. Haighton attempted to end the discussion by saying that at this stage it was up to Karn, Johnson, him and other interested parties to solve the problem and return to the Board with recommendations.

Hambly suggested referring to the text found in the report of the February Board meeting (*The AMSAT Journal,* July/August 2001, page 30) where it states ...we want to build a GTO satellite of about the size of the Johnson/Jansson proposals...that the Projects Committee...be encouraged to finalize a preliminary design. Clark asserted that it was also intended that the Projects Committee should come to the Board with other ideas. He remarked that at that meeting he had expressed the hope that the JJ project would not preclude our doing other things although the perception has recently been prevalent that the only thing AMSAT is doing is destined for GTO. He said that this bothers him. Tynan noted that at that meeting the Board had approved Karn's digital project as a separate item. He explained that what led to the present discussion was the statement made earlier that we can't afford to do both projects. Clark estimated the cost of a launch to GTO as $3,000,000 and declared that we could launch as many as 20 spacecraft to LEO for that amount. His perception was that some individuals believe that the decision to proceed with a GTO project has already been made, and he expressed concern that a GTO launch would be so expensive we could not afford it. Tynan opined that LEO launches will also be expensive and noted that King had made the point that many launches, possibly more than to LEO, are now going to GTO. Haighton again suggested halting the discussion and proposed that the Board issue a directive, subject to change, that we are looking for a GTO launch at reasonable cost. He added that within the next two weeks we should be able to make the decision because we have some good prospects for a launch costing $1,000,000 or less.

Daniels agreed that the discussion should be concluded because some of those present have indicated that they were uncomfortable about this matter at the time of the February meeting and now the concern of these same persons is greater while the urge to go forward is stronger for others. He said we have to deal with it but we can't solve it at this meeting. Soifer provided his recollection that what the Board had agreed to in February was that it approved a detailed study of the GTO mission and set out the parameters to be studied. He explained that, by definition, authorizing a feasibility study does not determine the outcome, rather, it is determined by the results of the feasibility study. He understands that this study is still underway and remarked that the Projects Committee has been doing excellent work on it and suggested that the Board wait and see what the Committee has to say. Baker questioned where the funds will come from. Daniels noted that one hardware project approved in February is now nearing completion while the others are still in the planning stage although our external Public Relations outlets are beginning to indicate that a decision has already been made. Soifer returned to his example noting that Congress may mandate something to happen but not authorize the funding. Until the funds are actually appropriated, nothing is done. He declared that the Board certainly never appropriated funds for the JJ project, rather, it authorized funding of the feasi-


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bility study. Tynan ended the discussion with no formal action having been taken, saying it was obvious that it will be necessary to come back to it when the Projects Committee completes its work.

### IV. Business Development Report

VP for Development Shepard reminded the Board that at the February meeting, a decision had been made to put together a Business Development Committee with the primary charter to expand our internal funding as well as develop new sources. A meeting of the Committee was held 18-19 August 2001 at which time a group of people having skills in a variety of disciplines got together to help with this effort. One accomplishment of the meeting was to notify the Board and others of the changes affecting our climate. Baker summarized these as follows. First, the changes in the hobby aspect wherein there is a shrinking user base, fewer technology oriented users and users who have made significant financial investment in equipment for our VHF and UHF missions utilizing CW and SSB. Also, there is less time available for the pursuit of hobbies. That includes the time available to AMSAT experimenters to devote to our projects. Also, we've come to recognize that free launches are a thing of the past and there are an increasing number of government constraints and regulations. Furthermore, there are new requirements for spectral purity of our transmitters. With regard to technology issues, the technical base is also changing because our experimenters are looking to do things they haven't done before, yet are also relevant to their interests. We must realize that the *wages* they receive in return for their contribution of hours is the pleasure they get out of what they are doing. The hardware and software is getting more complex and that calls for more structured approaches to our projects. There are financial implications since we don't now enjoy the luxury of much trial and error. Because launches are so expensive we tend to try to put as many features as possible in a spacecraft.

King declared that another external force is the pressure being exerted on our spectrum resources, including the concerns that Amateur Radio is no longer making the contributions to radio science that it once did. Thus, we are pressured to do whatever we can to show once again that we do things to advance the state of the art. It was agreed that the terrorist hostilities of 11 September 2001 will undoubtedly have a negative impact on our fund raising efforts, both from within and without our organization.

Shepard announced that Mal Preston had agreed to assist him as a member of the Business Development Committee, primarily to help with internal efforts to raise funds. For example, Preston and Haighton have launched the President's Club program that in August had 3 members and has now increased to 16 persons who have pledged to contribute $1200 or more per year. He said that program will be expanded and emphasized at meetings. With regard to external sources of funding, Shepard said that at the February Board meeting he had emphasized that, to raise funds from corporations and foundations, it would be necessary to emphasize the educational and scientific aspects of our projects. Therefore, we must include an experimental capability in the next project so that he can have a *product* to promote to that audience. He has lowered his expectation that we could raise $1,000,000 from external sources down to a figure of perhaps $300,000, but added that at present he cannot realistically raise any amount because the AMSAT officers and Board members have not been listening to his recommendations. He said the Board must make the decision to include an experimental package in the next satellite in order for us so to have a sellable product to show to our funding sources. We must also go back to attempting to fund the organization internally as much as possible because it isn't worth spending AMSAT's time and money to do otherwise at the present time. Baines asked Shepard how much communication has he had with Board members regarding this? The reply was that his communicating has been with Baker and Haighton and the latter is to whom he reports. Baines replied that these two did not constitute the Board and restated his question to which Shepard responded that the Board had not been responsive. Tynan explained that some Board members are trying to present a realistic attitude here and added that he too would have liked to have seen more direct communication with the Board. He said that what was perceived in February as Project JJ was that we were trying to combine *what hams want* with something we could do to *further the art of radio* in terms of a digital project and that is why we put the digital transponder on the JJ spacecraft. First, it would be a good thing to do in terms of technology and second, it would be a fund raising vehicle. Tynan asked if we don't have something on JJ that furthers the radio art then will it make our chances zero? Shepard replied that if we announce to a potential corporate sponsor that we need $50,000 to help build a satellite which will allow hams to communicate around the world, or one that would push the state of the communications art into the next generation and facilitating classroom experiments; which project do you think they would fund? He added he has said this several times but no one wants to do anything about it. Soifer noted that the VP for Development reports to the President therefore, the responsibility for communication with the Board rests with the President. Thus the issue should be directed to him to resolve.

Soifer also noted that support of educational experiments was brought up at the morning's IARU session. Addressed was a discussion of what does and what does not fit the category of ham radio and what are appropriate communications on amateur frequencies? He stated that things like monitoring the temperature and radiation environment of a spacecraft are indeed appropriate in that they contribute to the radio art because they can lead to building better spacecraft. He asked if the collection and analysis of data of this type would represent a sufficient educational content to enable us to raise the money needed or, might we have to consider missions involving more science? He offered the opinion that experiments not related to spacecraft design or *radio technique*, as that phrase is used in the ITU Radio Regulations, would have to be in a service other than the amateur service, or the amateur satellite service. Tynan asserted that basing a fund raising effort on having a satellite for student activities such as those mentioned is unnecessary because that can be done now with AO-40 and other existing spacecraft. Haighton said he had suggested going to schools that were interested in SAREX to ask them to nominate small projects that are compatible with Amateur Radio. Daniels reminded the Board of the short attention span of students for projects of this type. King suggested getting college organizations involved. Tynan noted that an offer made to students at the Naval Academy by Bob Bruninga to help build a small satellite resulted in no interest.

Baines said that he interpreted Shepard's statement as saying that a project must be presented in a way that supports the objectives of the granting organization and suggested that a way to obtain this might be to offer *space for rent* on the satellite so that we could offer a substantive approach with the educational curriculum established. He agreed that the project has to be presented in a way to persuade the grantor to support the project. He restated his concern that the Board members have not been kept current about the changes that have necessitated looking at things differently now. Thus, the challenge is to determine what it will take to make a project compatible with the interests of outside organizations and how will it be interfaced with our primary Amateur Radio focus. Tynan asked that if we include a new (to us) technology such as digital voice, how would we package it to be different from any of the commercial satellites such as Iridium or Global Star? For example, if we went to the Boeing or Microsoft Foundations, would that project be sufficient to convince them? The attendees agreed that it would not.

Haighton called upon Ken Chaffee who has written an excellent guide for teachers having a space science curriculum. Ken teaches basic space science to 5th grade students using as examples the Shuttle, ISS and some of the smaller satellites and brings ham radio into the picture. He added that he's hearing a different kind of thing here, i.e., looking at possible experiments that schools might be involved in. Tynan interrupted asking rhetorically how much money would a school be willing to contribute to AMSAT to be able to do their experiment? As objections were voiced, he explained that he was trying to make the point that education itself is not a funding source. Feller asked if a school would be willing to spend small amounts for texts and workbooks? Chaffee explained that he, as a retired high school teacher who works as a volunteer at an elementary school, would surmise that parent-teacher groups might be willing to make small purchases, but added that he personally provides the materials used in the classroom. He reported that he had discussed the subject of classroom experiments with AMSAT Education Liaison Steve Bible who wants to determine the requirements for a full ground station system and Steve thinks this is what we ought to be looking at.

Saragovitz commented that we need a book or text to show a foundation why they should support us, and it will not be to promote ham radio. She agreed that we need to pursue fund raising of this sort because the Amateur Radio community is not going to pay for the next satellite so we have to find the money elsewhere unless we find extraordinarily generous donors within the AMSAT membership. Otherwise, it could take up to 7 years to accumulate the money so this should be considered in our planning. Chaffee agreed that the schools were not a good source of funding and he opined that none of us could write curriculum materials that school districts would buy. Clark added that while this applies to grades K-12, the structure is different when you get to colleges and universities.

Shepard concluded his presentation saying that the WWW site (www://amsat-na.org) to be used for fund raising is with Baker's help now 85 percent complete and oriented toward repositioning AMSAT as a scientific and educational entity. He added that work is underway on a new brochure about AMSAT including involvement with GPS experimentation and ARISS as well as the Amateur Radio aspects. But, he noted that the brochure intended for foundations has been put on hold. Karn agreed that there was no way a non-ham organization is going to contribute funds, yet he believes education is the key here, and not just by simply supporting schools. Instead, he feels that doing something that encourages hams to improve their knowledge of advanced techniques is the direction we should be headed.

### V. Amateur Radio on the International Space Station (ARISS)

Bauer reported that preparing the ARISS hardware ready for flight is being done both at Goddard and at the AMSAT lab in Orlando and added that it's been a good team effort. Tynan asked if there was hope for an increase in Amateur Radio activity on the ISS, noting the Field Day operation was very good. Bauer replied there was a great deal of activity when Susan Helms was on board, but doubted that the present crew would be doing much. He anticipated that when another crew goes up they will much more active.

Clark stated that he would like to see more publicity about ARISS exploits appearing outside the Amateur Radio community.

Chaffee noted that school groups are looking toward future activities involving the project.

Saragovitz opined that the present ISS publication was ideal for Shepard to use and Daniels cited a video of a class talking to astronauts as another potential asset. Tynan offered the opinion that foundations would not be interested in the technology involved in ARISS but they might be interested in the fact that we are providing a means of challenging kids at the grade school level to become interested in science and technology.

The text of Bauer's report of the Human Space Flight project as presented at the just concluded Space Symposium is to be printed in *The AMSAT Journal*.

Clark offered a resolution commending Frank Bauer, VP for Human Space Flight, and his entire team for their extraordinary efforts. Haighton seconded and it was unanimously approved.

### VI. Strategic Planning Committee Report

Bill Burden VP for Strategic Planning reviewed the history of the Committee and its past year's activities. He stated that the purpose of the Committee was to develop for AMSAT-NA a *roadmap* to guide our future efforts. The first year's work was presented at the October 2000 meeting at which time it had progressed to the point where a Mission Statement had been developed that was based primarily on the original Bylaws and Statement of the Value of the Organization. At that time it was noted that the basic mission has not changed from what it was when AMSAT was founded. At a well-attended session held at last year's Annual Meeting the general membership was asked what AMSAT should undertake after Phase 3D? One suggestion was to have a program to mentor university satellite projects and to provide assistance with their frequency management problems. It was urged that any non-ham experiments included therein must provide some benefit to Amateur Radio. Another and more difficult subject was how we could go about building an amateur satellite system that would afford continuous coverage throughout the world.

Later in 2000 the Committee discussed the Vision Statement by e-mail exchanges, but they were unable to come up with a satisfactory wording. They also looked at external opportunities and threats as well as internal strengths and weaknesses. They still had a problem with the Vision Statement so in February 2001 there was a working session held at AMSAT headquarters to put together the draft plan. With the help of Barbara Saragovitz, a professional planner, the Committee was finally able to put together a statement of where AMSAT should be in 5 years. Burden summarized it as follows, we ought to go back to being an organization that builds, launches and operates satellites. He declared that the Board must now focus on that plan and the plan is to reestablish AMSAT-NA's presence in space through the development over the next 5 years of two or more satellites constructed by AMSAT-NA. These spacecraft should include advanced technology and innovative communications systems. The goals they came up with are that AMSAT-NA will 1) develop satellites for continuous amateur communication, 2) provide opportunities for members to participate on many levels, 3) be the primary resource for amateur satellite information, training and education and 4) acquire sufficient resources to support our vision. He declared that we've got to realize the environment has changed so we must do things differently than in the past. At the next level are the tasks that need to be performed to get AMSAT-NA satellites operating that have interesting technology and communications capabilities.

Burden noted that the directors and officers discussed the Plan and approved it in principle at the February 2001 Board meeting. (*The AMSAT Journal*, July/August 2001, pp 22-23). They asked the Committee to go back and refine some of the wording, which they have and resubmit it to the Board and officers for comments and suggestions. He emphasized that it is ultimately up to the Board to implement the plan and put it in action. Further changes were made based on inputs received and the refined version of the Strategic Plan was distributed at the present meeting along with the Committee's recommendation that it be approved. The text of that Mission Statement is as follows:

*AMSAT-NA is the principal North American Amateur Radio organization supporting the development of skills and specialized knowledge in the art and practice of Amateur Radio communications, as well as technology and science in space. We develop, build and operate satellite systems for Amateur Radio communications and experiments using Amateur Radio stations throughout the world.*

Soifer complimented the Committee for their work and noted that the Plan should not imply that AMSAT, rather than ARRL, is generally regarded as the principal North American Amateur Radio organization supporting the development of skills and specialized knowledge of the art and practice of Amateur Radio. Burden provided clarification that the sentence in question refers to space, not to Amateur Radio in general. Clark suggested inserting a comma between the words *Science* and *in Space,* to which Soifer agreed, adding that a strategic plan, must be a living document. Thus it needs to be continuously updated and asked that it define how this will be done as environments change. As an example he cited the situation where for the first time AMSAT-NA must coexist in a highly competitive environment in the world of space communications. He asked again how are we going to keep this plan going? Baines commented that a more basic question is how other organizations deal with such plans. Their boards traditionally do the planning whereas we delegated this to a committee, so perhaps Soifer's question should be directed to the Board rather than the Committee. He contended that the Board must decide what role it wants to play in evolving and keeping the plan up to date. Haighton suggested that the Board endorse the Plan now. Having done so, Soifer's observations become relevant. Soifer said that his remaining concern is that some of the Milestones are already outdated, but noted that will always be the case. Hambly, citing his experience said that he'd like to see the Board make it a formal activity to revise the plan every year.

Tynan asked for a motion to approve the Plan as drafted. Daniels asked if the specific persons named in the Milestones are part of the Plan and Burden said they were not, they are there for information only. Haighton moved that the Strategic Plan be adopted. His motion was seconded by Clark and passed by a unanimous vote after insertion of the comma mentioned above and after specific names were deleted. Haighton noted that the need for the Plan was one of the criteria developed at the Business Development meeting to show we are working in unity.

Tynan returned the discussion to the importance of periodically updating the Plan and suggested making it an agenda item to revisit at the time of the Board meeting to held at each Annual Meeting, and if necessary, at any other board meetings which may be held from time to time. Haighton noted that any proposals for changes be submitted directly to the VP for Strategic Planning with copies to Board members for their review. He added that the Committee should continue to function to maintain the plan. Burden agreed, adding they should also include reports on progress being made against the Plan. That prompted a short discussion relative to assessing performance. Soifer stated that, it is the performance of the organization, not of individuals, that is involved. He noted that, while measuring individual performance is valid in corporate environments, it is not appropriate in the case of volunteer organizations such as AMSAT. Daniels suggested, however, that all project activity be reported to the Board by the VP for Engineering - the only person in the organization who has under his responsibility all the on-going technical projects. Tynan noted this was already being done as a regular part of all Board meetings, but thought it might better be handled in the general meeting so that more members would be informed. He cited, as an example the rather detailed report on the ARISS Project presented at the Symposium by Bauer.

Haighton proposed a vote of thanks to the Committee members for their work, whereupon Clark offered a *sense of the board* resolution commending Bill Burden and the other members of the Strategic Planning Committee for their effort in developing the Plan and directing the President to continue an ongoing Strategic Planning Group that will continually monitor this document and AMSAT's meeting of its objectives. Tynan seconded and a unanimous vote was cast. Soifer noted that we will need a line item in the Budget to cover the Strategic Planning Committee's on-going expenses. Saragovitz said the office would take care of this interaction with the organization. It was agreed that the Strategic Plan would be made available on the AMSAT Web site and published in *The AMSAT Journal*.

### VII. International and IARU Matters

Soifer reported that in the past year, he had represented AMSAT-NA at the AMSAT-UK Colloquium and at the recent IARU General Assembly in Guatemala City. That General Assembly adopted resolutions dealing with unauthorized operations in the amateur VHF and UHF bands and also in providing assistance to the Radio Club of Guatemala with respect to operation in that country at 430-440 MHz. He announced that IARU Region 2 asks those experiencing interference to amateur satellites from unauthorized 2-meter operations in Mexico, e.g., from taxicabs, to document their observations and

to report them to their member societies to be reported to the Mexican government through diplomatic channels. In the USA such reports should be sent to Brennan Price at ARRL. Instructions for doing this are at *http://www.iaru.org* where links to the Monitoring Service may be found. Soifer said he will prepare a short article for ANS regarding this subject.

Most recently, the 2001 IARU International Satellite Conference was held this morning here in Atlanta. Hans Van de Groenendaal, the IARU Satellite Advisor, proposed replacing the currently vacant position of Frequency Coordinator with a panel of advisors, appointed by and reporting to him. This panel would consist of not more than 5 qualified amateurs nominated by the major AMSAT organizations including AMSAT-NA. At least one member of the Panel should reside in each ITU region and preferably, one should be knowledgeable about the university community and its needs. The Panel would advise Hans as requested in connection with his recommendation of suitable frequencies for specific amateur satellite projects and related matters. Those requesting frequency coordination would be asked to complete a questionnaire to be developed by Hans and the Panel. Past and present satellite frequencies, including those reserved for satellites under construction would be posted on the IARU region's Web sites to which AMSAT sites will be encouraged to link. The Forum approved this proposal in principle. However, in view of the current travel situation since 11 September, few representatives of AMSAT organizations outside of North America were not able to be present at this meeting. The Forum therefore directed that the proposal be presented to the other AMSAT organizations for comment prior to its implementation. Soifer said he would use the AMSAT-International distribution list to do this. Soifer then proposed as an action item that the Board express its support of this proposal and, if requested by the IARU Satellite Coordinator, to direct the AMSAT President to nominate a candidate to the Panel of Advisors. Clark so moved, Haighton seconded and the item was passed by a unanimous vote.

Soifer thanked Paul Williamson for his help in providing the e-mail facility distributing AMSAT-International information.

Soifer continued his report saying that concern was expressed at the Forum about the growing problem of university satellite missions seeking to use amateur frequencies for non-amateur experiments and added that it is a global situation, not limited to the USA. Hans has agreed to prepare a short paper about this for circulation to the IARU Administrative Council and has asked AMSAT-NA for assistance in doing so. Clark moved that it is the *Sense of the Board* that we do this. Daniels seconded. Baines asked for a clarification as to the nature of the support that had been requested. Soifer replied that considering the environment in the USA with many potential university projects, AMSAT-NA was the best source of first hand information, although while Hans is familiar with the university situation in South Africa, he would like to develop a channel for information from the United States. Soifer continued explaining that Hans plans to write a report for the Administrative Council, and wants help in making certain that it is correct. Soifer foresees one or two AMSAT-NA people working on that with Hans. Clark supported King as the best to do this because of his experience. King agreed to take on this task and stated that at the Small Satellite Conference in Utah it became clear that this was an ongoing issue. Thus he feels compelled to act on it. He said he sees the need for universities to organize a forum to find a resolution to their self-created and growing problem of frequency utilization. He declared that the best way to protect Amateur Radio is for someone to act on behalf of both interests. Haighton expressed his delight that King was willing to take on this difficult and important effort. He added that he has been worried about the situation and suggested that King and Soifer work on this as an official AMSAT committee.

Clark noted that an early resolution of the problem is needed because of the upcoming launch of 18 Cubesats. King replied that the first step is to learn if any of the applicants really qualify as Amateur Radio spacecraft. As an example he mentioned an upcoming project in Japan. For many others in the US, he intends to assist them in applying to the FCC for Part 5 licenses. Haighton pointed out that some have already invested in equipment to operate in the amateur bands and he suggested they may not appreciate King's advice.

As he had before, Tynan suggested that AMSAT-NA encourage the formation of a dedicated, ITU recognized radio service to meet the increasing needs of universities seeking to operate satellites for the collection of scientific data. He agreed that creating such a new service would be difficult and would require considerable time to accomplish. Nevertheless, he contended, if it can be done, it will happen sooner if it begun now rather than later. This prompted a protracted discussion regarding potential radio services which might fit the needs of university satellites which are not appropriate to be on amateur bands. No action was taken.

Daniels reported that he and Perry Klein had spoken to a representative of the FCC about the university problem and specifically about the possibility of acquiring STAs for these short-lived missions. Tynan pointed out that the use of the STA mechanism might result in these assignments being made in the ham bands. So, that might not be the best solution as far as we are concerned.

Haighton asked King, Daniels, Soifer, Feller and Klein to provide an analysis the entire situation and report to the Board.

Baines asked whether the VP for Education should be made aware of King's efforts. Haighton offered to make the notification.

Haighton then mentioned an announcement made by Twiggs that AMSAT had agreed there would be a 200 kHz wide portion of the 2 m band available for experimental use by the Cubesats. This pronouncement was ardently questioned by those present. Clark noted that he had offered to help with the problem of university sponsored satellites and said that he and Jan had agreed to talk to Twiggs about this, but because of scheduling conflicts it had not yet happened so there is still the need to bring him into accordance with AMSAT's efforts. He added that he had tried to help the Starshine project with their short term problem associated with its recent launch.

Tynan asked if Starshine, Sapphire and PCSat will be requesting OSCAR numbers. Clark replied that Starshine will request one, but the other two are uncertain. Tynan then asked if Starshine qualified as an amateur satellite to which Clark replied that in his opinion it did, and noted it is not obnoxious to other users of 145.825 MHZ because it transmits only a one second packet every three minutes. Soifer reminded the Board that when AMSAT wrote the procedure for assigning OSCAR numbers, one of the principles was that it would not put AMSAT in the position of being *satellite cops*. For the purpose of assigning OSCAR numbers we will rely on the owner's statement that their spacecraft is compliant with the IARU Guidlines and that they are requesting an OSCAR number on that basis.

**VIII. The President's Report**

Haighton cited the report he presented the previous day at the general meeting and asked that it be entered into the Minutes. The text follows.

*To say that the year 2000/2001 was an interesting year to be president of AMSAT is an understatement to say the very least, we the AMSAT members, Officers and BoD have gone from the heights of success to the depths of despair and back again several times during the past 12 months. Certainly being elected by the Board of Directors as your President was a highlight in my life, and I thank you all for your support during the past year. As a Canadian I have had to learn many things about the USA, particularly about your laws and political customs which are different from those in either the UK where I was born or in my adopted country of Canada where I have spent most of my adult life and all of my working life.*

*The past year started with the Phase 3D team in Kourou preparing Phase 3D for launch and in mid November ArianeSpace put the satellite through a near perfect launch. Our hopes were high as Ariane 507 ejected Phase 3D into orbit. At first we noted a minor problem as the 70 cm transmitter failed to operate, but then the 2m transmitter was activated and all was right again and Phase 3D was renamed as AO-40 by Past President and Chairman of the Board Bill Tynan W3XO. I was taking a brief vacation in the UK, visiting relatives when a 'phone call from the USA alerted me to the first problem with the 400 Newton motor and that we now had an apogee of about 60,000 km, so I thought we can live with that! But the next problem was the possible loss of the satellite - nothing was heard for about 10 days. No longer do we need to go into the why's and wherefore of that incident. But for 10 long days it seemed that we had hit the bottom of the pit and had lost our wounded satellite.*

*On Christmas Day 2000, we had the best Christmas present that could have come, our New Zealand Command Station successfully activated the S2 2.4 GHz downlink and once more we were in contact with AO-40. Over several months different parts of the satellite were tried out, and slowly it was determined that the 2 m and 70 cm transmitters were not working but that the 2.4 GHz transmitter was quite operational, and that it was quite easy to receive telemetry on the downlink.*

*Meanwhile your BoD met in Orlando to determine what we should do to back up AO-40 and how soon could we do this? The BoD laid down the outline of the satellite known currently as "JJ". By the way, did I tell you that we have a competition to rename "JJ". Send me your entries by E-mail and the Biz Dev Committee will judge the result. In case of a tie the first one opened will be considered to be the winner with a free ticket to next year's Dayton AMSAT Dinner. "JJ" will be a satellite containing 2 m, 70 cm. 1.2 GHz uplinks and a 2.4 GHz downlink in a GTO orbit.*

*On May 5, 2001, AO-40 was opened for the first time for SSB contacts using a 70 cm uplink and the S2 2.4 GHz downlink, and I recall the great pleasure of making my first contacts all over the USA and Canada as well as Australia, New Zealand and Japan. That morning we once more hit the heights, later on we were able to work the S1 2.4 GHz downlink with its increased antenna gain and there was*

*even a thought of trying the 2 m transmitter again. Much to everyone's disappointment, the S1 transmitter failed and has not been recovered.*

*Meanwhile in July the AMSAT-NA Project Committee met in Denver, Colorado to review the BoD direction for "JJ" and to start the process of initial design. At that meeting responsibilities were handed out to the various volunteers, and it was decided that a Preliminary Design Review would take place around the end of the year. Based on these discussions a budget was established and a time frame struck for the satellite. The estimated maximum cost including launch was $3,000,000 and the launch date the first quarter of 2004.*

*In August the new Business Development (Biz Dev) Committee met in Washington to review the budget and time frame to see if it was considered practical to raise the funds in the time available. Generally, it was considered that the raising of $1,000,000/ annum is practical but it would take some time to "ramp up to that level." Accordingly we are looking to reduce the launch costs of "JJ" if that is possible.*

*At the same time a further LEO has been proposed for a modest $200,000 inclusive of launch, this proposal will be taken to the BoD for consideration. If it is looked upon favorably then full details will be provided to the membership.*

*At the request of NASA a particular effort has been made to determine if the GPS experiment on board AO-40 is working. We were afraid that with the satellite cutting through the radiation belts on every orbit, that the GPS receivers may have failed. Fortunately this has not been the case and with the RUDAK working, both the A receiver used for GPS near apogee and the B receiver used near perigee have worked well. As I write this, data is being* received and sent to NASA for decoding.

*Additionally, the Ka 24 GHz transmitter is now working and reports are coming in from Europe and North America of successful contacts using that band. A breakfast was held here Saturday morning for people who are interested in operating this band.*

*Like all members of AMSAT I was delighted to learn of the successful launch of an Athena rocket from Kodiak, Alaska. On board the Kodiak Star were PC Sat, Starshine 3, Sapphire and Picosat-9, the latter from the Air Force Academy, Colorado Springs. Initial reports look positive, but are yet to be confirmed.*

*So much for the past, what about the next year? Well, firstly we will continue with the work started in the past year, it is important to increase our membership and funding of our projects will be a big part of our emphasis. We must find ways to involve more amateurs in the satellite part of our hobby, and every member is a potential donor. We need to "spread the load" a little so that each officer can have a backup and share the work with him or her. We need to have more volunteers, both technical and administrative. People who are interested in helping AMSAT in many different aspects, accountants, lawyers and business administrators as technical people. If we had people who could spend only an hour or two a week doing AMSAT things then we would be able to make a great deal more progress in the many functions of AMSAT. - Your questions Please.*

Haighton then provided an addendum directed to those present at the Board meeting. He asked for more help in obtaining information or comment in response to his e-mail queries and declared that a few Board members respond immediately, but there are others who do not reply and he would like to hear from them even though they may have no opinion or expert knowledge of the subject. He added that his requests are sent because he needs to know what the Board members, who represent the members, are thinking and because they have the experience that he, as a newly elected President may lack while he is *learning the ropes*. He is taking his responsibility as President very seriously and trying to do the best he can.

Tynan commented that when a person volunteers to run for a position on the Board they need to know that they are committing to spending long hours of arduous, and not always agreeable time. Furthermore, the officers, project workers etc. that attend these meetings should schedule their time so as to permit full participation. Everyone cannot be first on the agenda to permit their early departure. He declared that the Board meeting is the most important event which occurs at the Annual Meeting, although perhaps the least fun. He explained how he tries to arrange the agenda to accommodate as many as possible. Clark noted that this year the late start was mandated by the need for the IARU meeting to be held a day later than usual.

Haighton announced that he plans soon to review the AMSAT organizational structure in the light of changes in the external environment, financial matters and with regard to the Strategic Plan. He added that changes may or may not be needed and this is a task he has set for himself with the help of the appropriate officers. Any proposed changes will be brought before the Board for discussion.

### IX. The 2002 Annual Meeting

Keith Pugh announced that the next Annual Meeting and Space Symposium is planned for the Veteran's day weekend in Fort Worth, Texas. It will be held at the Lockheed-Martin Recreation Center. Several hotels and eating-places are nearby. Meals, including the annual banquet, will be catered at the Recreation Center. The Lockheed-Martin Amateur Radio Club will be the host for the meeting. If plans can be made, and if sufficient interest is shown, a tour of local surplus stores will be held the day before the meeting. An antenna range and noise figure measuring activity is also planned. Shuttle buses are planned to run from the hotels to the meeting site and the Lockheed club has three repeaters that can be used for communications by the attendees. In answer to a question, he said that no security issues are anticipated. Baines said a room would be required for the Area Coordinators' Breakfast and they would prefer this to be at a hotel. Tynan reminded Pugh that a room for the Board meeting will also be needed for all of Sunday and half of Monday.

Clark noted that Fort Worth is a convenient destination for air travelers. Saragovitz asked if vendors would be allowed to display their equipment to which Haighton replied he had no objection to having satellite related equipment on display but he would object to the holding of an open flea market with commercial vendors. Pugh suggested that perhaps a satellite-oriented flea market be set up for private sales at a specific time and place. Haighton declared that might be all right and agreed to leave it to the host to set that policy.

### Closed Session

A closed session was held to discuss the effect on AMSAT of certain U.S. Government regulations dealing with interchange of satellite related information and hardware with citizens of other countries.

Board Chairman Tynan issued a statement following the session that the close session had been successful and decisions were reached regarding our future course in connection with these regulations.

### X. The Phase 5A Project

Haighton reported that he and several other AMSAT-NA persons have been invited to attend a workshop to be held late November in Marburg, Germany to discuss the proposed Mars mission. He announced that he plans to attend this meeting, but did not believe we should fund any other attendees. If others wished to go as individuals, or through funding other then than from AMSAT-NA, we should have no objections. In addition to collecting information regarding the proposed Mars mission, Haighton thought this workshop would afford him a good opportunity to meet with Meinzer and Guzelow relative to various AO-40 matters. He said he would report back to the Board following his return.

Tynan noted that AMSAT-NA has not been asked to participate, and Haighton indicated it does not seem likely we will be, although various individuals have signified interest. Daniels reported that AMSAT-DL wants technical collaborators but agreed that AMSAT-NA, as an organization, would probably not be invited to participate. He added that the agenda for the workshop includes not only the Mars project but also a "Phase 3XX", a possible AO-40 follow-on project. Tynan agreed that it might be worthwhile for Haighton to attend and report back what is being planned and what might be asked of some of our people. He expressed some concern that P5A activities might divert the time and energy of people we need for JJ and other AMSAT-NA projects. Daniels responded that he believes that most of them could handle Phase 5A and as well as our work, and expressed the opinion that it represents the kind of project they might be interested in doing. Tynan noted that Phase 5A might present a potential opportunity to derive some funds from AMSAT-DL should they wish to utilize the spare AO-40 spaceframe now at Weber State University. He reminded the Board that the agreement we have with Weber State calls for that spaceframe to be supplied to us, should a need arise, and noted that we have a substantial investment in this spaceframe as well as in the documentation for the structural upgrading which would probably be required to allow it to meet the launch environment. He indicated that he believes AMSAT-DL should be given a license to use such documentation along with the spaceframe itself, if they indicate a need to unitize it for the Phase 5A vehicle.

Tillman announced that Dr. Meinzer's two-part article describing Phase 5A has been submitted to *The AMSAT Journal* and will appear soon.( *Editor's Note: See the November/December 2001 and this issue of The AMSAT Journal for the Phase 5A article.*)

Clark asked if there will be an AO-40 Program Board meeting while the satellite is in the commissioning mode because there are some issues to bring up. Haighton replied that he has been informed there should be a meeting and has asked for one, but that the agenda for the Marburg workshop does not show such an activity. Clark said that he believes that Joel Harrison, the ARRL representative to the Program Board, does not intend to attend the Work-

shop. Haighton agreed to bring up the question of an AO-40 Program Board meeting with Guelzow. Clark suggested holding a Board meeting by conference call before any meeting of the Program Board is held, and inviting Harrison to participate.

### XI. The CanadaSat Project

Haighton provided the background of a proposal received in early summer from a small Virginia company called SpaceQuest which has expressed interest in establishing a Canadian branch. To begin to train Canadian citizens who would staff this branch in techniques of spacecraft design construction and testing, they have proposed they build and launch an amateur spacecraft. Haighton said he has already provided SpaceQuest with names of some people interested in staffing the new branch, all of them licensed amateurs. Haighton noted that SpaceQuest was founded by two AMSAT-NA members, Mark Kanawati N4TPY and Dino Lorenzini, KC4YMG and noted that both of them had participated in our MOST effort. They have been consultants to a number of small satellite projects and have expertise in ultra miniature hardware. They have been trying to put up their own spacecraft as a proof of their commercial capability. They have already begun talks with the Canadian Space Agency (CSA). Haighton continued, stating that SpaceQuest has asked if AMSAT-NA would be willing to be involved and to provide some funding? In response, he asked them to provide a written proposal to take to the Board.

The spacecraft is to be a 25 cm cube of approximately 10 kg mass, having up to 7 watts of RF output, built using existing components and techniques. It was noted that it very much resembles the microsats. The plan is for it to be launched within the next 18 months. Two UHF transmitters and four VHF receivers plus a possible wideband receiver with SSB, AM and FM demodulation are proposed. The satellite should provide analog loopback, digipeat, store and forward GMPSK digital modes operating at up to 56 kbd. Antennas would include a 4 element UHF transmit antenna and a one element VHF receive antenna. Power will be supplied by NiCd batteries and GaAs solar cells. The laboratory facilities will be approximately 1000 $ft^2$, have a clean room, work benches, computers, tools, a small thermal chamber and freezer. Personnel will include most of the persons Haighton had referred plus some others known to AMSAT. The Amateur Radio sponsor will be the Burlington (Ontario) Amateur Radio Club.

Haighton noted that SpaceQuest has suggested this could be an advanced replacement for AO-27 with both analog and digital modes that could be used by hams worldwide. A 12-month step-by-step schedule was proposed for defining requirements and design parameters, setting up and equipping a small satellite development facility, construction of a *flatsat* for integration, testing and software development. If the schedule can be met SpaceQuest has a Russian launch in mind. The proposed total budget calls for US $200,000 including launch.

Clark asked what SpaceQuest wants from AMSAT. Haighton responded that we are being asked to contribute US $200,000.

Haighton noted that the Canadian government has recently instituted new regulations which may make doing such a project in Canada less attractive than heretofore. He indicated, however, that SpaceQuest is interested in pursuing the project with AMSAT, whether the spacecraft is built here in the U.S. or in Canada.

Clark expressed the opinion that the technical description sounds like a logical evolution, so he sees no problem with feasibility. Nevertheless, the idea that AMSAT simply pays for a satellite is a new concept. Haighton offered the opinion that the project will train a set of present AMSAT members who have not previously built satellites. Clark noted that it sounds as if SpaceQuest is attempting to establish a new division in Canada for their own purposes, the need for which may have suddenly gone away. Tynan asked if CSA was presently a party to the proposed project, or it is simply a demonstration to encourage them to buy future spacecraft from SpaceQuest. Haighton said that, in his opinion, it represents a demonstration of their capability to CSA.

Tynan asked if it would be feasible to include the bent pipe transponder for use with Karn's digital experiment? Haighton replied that he had requested Karn to speak with Kanawatti about this, but that has not happened yet. Clark declared his technical concern is that this is basically an unstabilized Microsat while Karn's venture would probably best be done at L and S bands and likely require stabilization. He noted that, on the other hand, flying another AO-27 small passband linear transponder sounded good to him, and he believed that it could succeed; but was concerned about the minimal involvement of AMSAT technical people. Soifer recalled that there have been two Amateur Radio organizations who contracted to have a satellite built, i.e., AO-8 built for ARRL and three Fuji Oscars for JARL, so if we find SpaceQuest's project feasible, ARRL might be asked to come in as a partner and underwrite part of the project because there is a large user demand among their members for another FM spacecraft.

Daniels voiced support of the project saying it would be an attractive way to carry out the exploratory work for Karn's project if the problem eluded to by Clark can be resolved. He noted that Kanawatti is among the foremost practitioners of small satellite hardware. He noted that much of the hardware is probably already beyond the breadboard stage. Haighton agreed that is probably true.

Possible ways to provide stabilization and an S band antenna for the satellite were discussed at some length. Tynan questioned whether SpaceQuest is currently in a position to build equipment operating at frequencies higher than L band, so perhaps we can provide help with that aspect of the project.

Soifer asked for details of the proposed launch and orbit, to which Haighton replied that it would be a 600 mi circular LEO via Russian Dnieper vehicle. Clark expressed the opinion that this sounded like a good orbit for Karn's project.

Baines asked for a clarification of the sponsorship by the Burlington Amateur Radio Club. Haighton replied that they would supply people to do odd jobs and added that Lorenzini had requested that SpaceQuest not be the sponsor. It was suggested that AMSAT-NA could not be the sponsor because CSA would want Canadian sponsorship. Baines asked why, if funding came from AMSAT-NA, should the glory go to the Burlington club? Haighton replied that it has to be an AMSAT satellite, licensed in Canada and owned by the Burlington Amateur Radio Club. Tynan suggested that the Projects Committee technical people consult with SpaceQuest. Saragovitz suggested that Daniels make the initial contact. In response to a question by Williamson asking who would have operational control after launch, Haighton asserted that there would have to be a Canadian control station. Daniels then suggested concluding the discussion and recommended that, he, Clark and Hambly meet with Lorenzini and Kanawatti to look carefully what they are proposing, and report to the Board before any decision is made. This approach was agreed upon.

### XII. Far Side Lunar Radio Astronomy Project

Dr. Paul Shuch described a mission opportunity presented at an international astronomical society (IAA) committee meeting. They are considering locating a radio telescope on the far side of the moon that would relay data back to Earth. Although the study group has been funded, the mission has not, and no launch opportunity has been identified for what may be a 10-20 year time frame. He announced there was an opportunity for AMSAT to contribute to solving the problem of how to get the data back from the far side if the moon is designated as a planetary radio quiet zone. One proposal heard at that meeting was to provide a store-and-forward Pacsat type spacecraft in lunar polar orbit that would transmit only when on the near side of the moon. The committee had asked him to come to AMSAT to suggest that we might want to be involved. He said that if the mission is funded the relay satellite will be also, so this is an exciting opportunity that few organizations other than AMSAT could handle.

Clark expressed concern about the instability of lunar orbits saying that almost no orbit around the moon is long lived. Shuch commented that what he liked about AMSAT was that it immediately saw problems and could offer solutions. He concluded saying he'd like to go back to the IAA and tell them that AMSAT is aware of a number of problems and it would be worth contacting us if their plan goes forward.

### XIII. MOST Project Report

President Haighton read the following report sent by Dr. Robert Zee VE3RZ, Manager of the Space Flight Laboratory, University of Toronto Institute for Aerospace Studies (UTIAS) with a request that it receive careful attention.

*Since last year we have proceeded to build and test protoflight models of all of our electronics. Currently, we have our flight boards built and they are being tested at this very moment. The past year has not been without its challenges. Specifically, we faced the following obstacles.*

*1. In December 2000 we lost our communications engineer. Until this point we had been developing our own radios. We understand fully that this was a risky course to take, and did not ignore the advice that AMSAT had provided on this subject. Still, we wanted to make the attempt, since we were being funded not to just build one satellite but to establish a program to develop new technology. We had a definite cut off date for this activity, however. If the radios weren't ready by the first quarter of 2001, we would purchase off-the-shelf radios and still have time for integration and test. Moreover, a separate budget was allocated for such an eventuality. When our communications engineer departed for another job, we quickly moved to implement Plan B. We were successful at acquiring "off-the -shelf" radios from Emhiser that were tuned to our specs. This was done within our budget. We also hired a replacement engineer who is currently exceeding our expectations. We have also hired another RF engineer who is helping with the integration effort and is also continuing to work on the custom ra-*

*dios on a non-critical parallel path (i.e. for future missions). Again, all this is being done within our original budget.*

*2. Around July 2001, we got word from CSA's new frequency consultants (Telesat Canada) that they noticed that our power flux density was above the recommended limits. These limits are set by ITU, and indicate the power flux densities for each band below which interference with terrestrial users is negligible. If our power flux density was above the limit in our frequency band the consultants would have to initiate a detailed coordination effort with the countries that objected to our first ITU submission in 1999. This was something that the consultants wanted to avoid. At first, we thought that we might have made a mistake in our PFD calculations. We checked our records, and the PFD we reported in 1999 was correct. Either the previous consultants (ComTec) failed to recognize that we were above the limit in 1999, or they understood and expected that detailed coordination would occur. But the new consultants (Telesat) decided against detailed coordination, and instead told us to reduce our PFD. This required major changes to the satellite and ground station very late in the project. CSA recognized this to be "not our fault" and agreed to put in the extra cash to make the changes. We were caught in a really tough situation, with time running out and a lot of money that had to be spent very quickly. We prevailed however, and now expect to get our new PSK transmitters this October, along with new quadrifilar antennas for MOST. We have also added a coding board in the satellite transmission path to implement ½ rate convolutional coding. This board has been built and works. We have acquired an off-the-shelf PSK transceiver for our ground station and have made the necessary modifications to our down converter and decoding system. We are now in good shape with the coding system fully tested. We need to complete the unit tests on the radios and put them in the loop as well.*

*3. In early 2001, we erected a temporary antenna tower to test our heavy-duty antenna rotator. We had purchased a 3m and a 2m dish. We understand that AMSAT had concerns with being able to accurately control a 3m dish with ham equipment. The rotator manufacturer claimed that the system could meet our pointing requirements with a 3m dish. So, we decided to do some tests to verify this. While the system works well even through snow and ice, it needs to be calibrated very frequently. To avoid frequent calibrations, we plan to use a solid 2m dish for communications with MOST. We designed the new downlink system to give us a nice link margin despite the fact that we are using a smaller dish.*

*4. The V53 Rev C board has given us many problems. In early 2000, we decided to purchase the V53 computer from SpaceQuest on the advice from AMSAT that designing our own housekeeping computer would be very risky and hence unadvisable. However, for the longest time the V53 has been on the short list of potential mission killers. Only in the last month have we begun to see the light at the end of the tunnel. Problems included losing bytes through the HDLC serial communications controllers and progressively slower file transfers leading to a crash. The former problem was discovered to be a problem in the FPGA software causing multiple chip selects to be asserted at the same time. Lyle and Chuck replaced the FPGA and now it works fine. To get to the point of replacing the FPGA, it took a lot of effort on our part to try to debug hardware for which we didn't have schematics and software or which we didn't have the source code. We had to work with Harold to solve the problem which was a long and painful process. The second problem (V53 crashes and really slow file transfers) has still not been resolved. We have worked with Harold for over 5 months on the problem without a resolution. On our own, we ended up working around the problem by increasing the crystal rate to avoid problems with the downlink queue filling up which would lead to a crash. We are keeping our fingers crossed that we will not load the V53 file to the point where we run into this problem again. We have increased the crystal rate by a factor of three to hopefully give us some processing margin. There is one problem associated with this rate increase, however. The A-to-Ds on our SPI bus are now checked beyond their spec'd limits. We are not happy with this as it presents a reliability issue. It may work for 1 week at standard temperature and pressure, but we don't expect it to work in space for 1 year. So we have been working with SpaceQuest to try and get the FPGA modified yet again to reduce the SPI rate to an acceptable level. Unfortunately, SpaceQuest does not see this as a warranty issue with the V53 and so it is charging us US$3,600 to make the modifications. As we are very tight on money, we are thankful that AMSAT has agreed to finance part of the amount (otherwise there would be pressure to do unreliable things like dead-bug divider chips on the board).* At this point Haighton added that he had talked to Zee about this, saying he recognized that part of the problem seemed to have involved AMSAT and we would provide about $4,000 toward the cost of finding a solution. This would come from monies UTIAS had previously paid to AMSAT.

*5. LEAST has been dropped from the mission as per Robin Haighton's request. We understand that this is a cost issue and is not because UTIAS is uncooperative or unwilling to integrate LEAST. In fact, we had hoped that the LEAST team would visit us not only to talk about LEAST integration , but also to get an informal in-the-lab update of our progress. We also understand that this action is not meant to be an indication of non-confidence on the part of AMSAT. We are fighting hard to make sure that the LEAST tray is left empty. This is not an easy battle.*

*6. Our launch has been selected, although the contract signing has been delayed by the Treasury Board. Currently, we plan to launch in August 2002. We cannot disclose our launch vehicle until the contract has been signed. The late selection of launcher by CSA has introduced delays in finalizing the spacecraft structure. Even now, we are having difficulty finishing one of our spacecraft panels because technical exchange is extremely difficult without a contract in place. We do not want to go ahead with our current panel design without review and approval since the solar cells are irreplaceable. The launch interface issues are also holding up the design and manufacturing of the final five trays in our tray stack.*

*7. In early 2001, we have had our thermal model reviewed by Maya Heat Transfer Technologies. Some corrections were made, and we are now able to do away with the MLI completely, allowing us to save a substantial amount of money.*

*8. Our structural FEM was also recently reviewed by an independent contractor, and appears to be OK.*

*9. The instrument electronics have been giving us problems. This is a custom DSP board, built upon the CCD controller originally used by the astronomers for the Magellan Star Camera System. The problems are not associated with our computer design, but with the very stringent requirements of the measurement system or "signal chain." Designing a board with the switching power supplies while taking low noise images presents many challenges. After consulting with an EMI specialist, changes were made to the board design. The current flight boards have very low noise to the satisfaction of the astronomers. Still, there are a few annoying hardware bugs left to be fixed. This is one of the computer boards that had to be designed in house, since no off-the-shelf units were found that could meet the requirements of the astronomers. Two flight boards have been assembled and we are in the process of working through the bugs with UBC (University of British Columbia).*

*10. The ACS Computer is another custom made computer, and in contrast, has worked well (no low-noise measurements to be made).*

*11. The flight harness has been built and is currently undergoing tests. We have constructed the necessary GSE to test the harness without removing it from its wooden tray stack mockup. The harness will only be removed when it is time to integrate it into the actual tray stack.*

*12. A first cut of all our housekeeping software has been written, except for two tasks that are awaiting the completion of hardware.*

*13. All initial software elements are in place for our ground station except for a few terminal programs to work the CCD DSPs and ACS Computers.*

*14. An operations plan has been written to guide spacecraft level design.*

*15. We are formalizing our test documentation and will begin acceptance (functional + environmental) testing of all units shortly. We have staffed up to support this effort.*

*In summary, I would like to thank AMSAT for their support of this mission. We have found AMSAT's advice to be very valuable to our project planning. Although it may not seem like we are heeding the advice of some of our mentors at any given time, there are always more complicated issues to work through. Certainly, the advice from our mentors has been "We can give you our opinion, but it is up to you to determine the suitability in your context." Much of the irreducible complexity that is present in the spacecraft is a result of the mission parameters. We have worked to implement reasonable approaches to solve our unique problems. I hope that despite the frustration inherent to any spacecraft project, we can continue to work on good terms with AMSAT. I have been a strong supporter of AMSAT within my organization. I believe both our teams need to receive support and encouragement from their leaders.*

*Sincerely,*

*Robert Zee*

A short discussion followed. Daniels asked about their launch. Haighton replied it would likely be on a Russian vehicle. Tynan noted that new Canadian regulations may complicate matters. Clark recommended for the purpose of keeping the minutes brief, including only the first and last paragraphs, however, it was finally decided to include all of Zee's report without editing.

### XIV. Field Operations 2001 Accomplishments

VP Baines announced that it had been a good year for his group. Activities of the field organization since January 1 included acting as ambassadors of AMSAT and offering AMSAT publications and software at 27 hamfests, conducting local area nets, making presentations at club meetings, serving as Elmers and encouraging satellite activities at schools, hospitals and on Field Day. An effort is being made to increase visibility of the Area Coordinators in the communities they serve. A 5-hour Satellite Workshop was held in Riverside, CA with 70 persons present.

The number of Area Coordinators increased from 166 to 189 in the US and Canada and there are also 5 representatives in countries that do not have their own AMSAT organizations. A listing of the Coordinators is published yearly in *The AMSAT Journal* and is supplied to all new members as well as being posted and updated on the AMSAT Web site. It is noteworthy that requests for information are being received from all over the world. Most of the books offered by AMSAT were updated in 2001 as well as the *Area Coordinator's Toolkit* CD-ROM.

Future activities include wider participation at hamfests, encouraging Coordinators to make presentations using the tools that have been provided, continue updating informational materials, developing fund raising materials, recruiting more volunteers to serve with the Field Ops organization and developing local nets.

A brief discussion followed and it was mentioned that, with the exception of the UK where AMSAT-UK volunteers make information available, not much is known about how AMSAT organizations in other countries provide help to beginners. Soifer said at the recent Region 2 meeting he had highlighted the activities of the AMSAT-NA Area Coordinators activities. Tynan asked if it would be possible to have some AMSAT publications and software translated into Spanish. Candidates for this task were suggested. These included Feller's mother who is a licensed translator and holds an amateur license. Haighton declared that AMSAT-UK still needs help from us in providing material for *OSCAR News* to which Russ Tillman replied that *The AMSAT Journal* has had a working arrangement with AMSAT-UK and AMSAT-DL, and now AMSAT-Sweden for swaping articles and translations. It was suggested that we give away a small incentive such as a decal to those who sign up as new members at hamfests. Baines asked for suggestions about materials to be prepared for Field Day use.

### XV. AMSAT Internet Facility Report

VP for Electronic Publications Williamson announced that the software for the facility had been upgraded in the past year and it now runs faster with plenty of disk space. AMSAT BB has 1235 subscribers, ANS has 2450 and Keps 6445, plus there are some smaller lists. These lists are increasing, especially Keplerian elements. There is about half a gigabyte of material on the Web site. Automatic processing of the alias lists has been implemented which has considerably reduced his workload. About 4000 mailing list requests are now being received each year. There have been about 32 Mb of AO-40 telemetry automatically archived. There are still things to do including developing a search engine on site, primarily for the AMSAT BB archives. He said he would like to be able to keep the information more current, especially regarding PCSat and Sapphire, but no information on these satellites has been sent to him. Suggestions for other features to include were welcomed, especially from those willing to do it. On a typical day the WWW site moves 40,000 file transfers.

Because of AMSAT's high dependence on computers, Tynan asked why valid virus alerts could not be posted to some mail lists. Williamson replied there are many sources for that information and we might incur a liability in doing so.

Haighton asked Williamson why the AMSAT mail facility rejects the mime format. His reply was it was for economy of size and for virus rejection, adding that he is currently debugging a program to strip off unwanted characters to produce text only and this will soon be added to the mail manager.

Tynan asked if any changes to Williamson's budget are needed. Upon replying in the affirmative, he was asked to send details to the Treasurer, Corporate Secretary and members of the Board.

### XVI. AMSAT News Service (ANS) Report

Haighton read the written report submitted by VP for Public Affairs and ANS editor Dan James who defined ANS as a free, weekly news and information service of AMSAT-NA that is first released via the ANS worldwide e-mail reflector followed by live transmissions on the 20 m AMSAT-NA nets held each Sunday and other nets throughout the country. James provided a brief summary of his background, ANS history and activities. He stated that because there is no official pipeline of information feeding ANS we are often scooped by other publications. Nevertheless, he is grateful to those who send him material and this situation is improving. Dan stated that the format used to transmit ANS was originally designed to be compatible with packet radio transmission and so does not permit the use of most newer and more dynamic formats. He noted that, in the US, the packet system is no longer highly used. Thus he favors a format change that would accommodate color photos, etc. James also speculated that perhaps in the light of advances in communications technology, ANS may have outlived its usefulness. Nevertheless, he said he is looking forward to continuing his involvement if the Board so desires.

Clark agreed with James that the present physical format of ANS is outdated and he sees no reason to preserve this old format. Soifer countered that there are reasons for retaining a text-only format for e-mail because of the popularity of Palm Pilots and similar devices. It was generally agreed that, before any format change is made, ANS recipients should be consulted.

Daniels expressed the opinion that too many memorials were being posted. Haighton agreed saying they were getting longer as if to fill space when there was not much news. He agreed, this was unnecessary.

Haighton recognized that AMSAT is not a news gathering organization and connot be expected to lead everyone else with breaking news. He said that if James is notified of an event he is sure he will do his best to act on it. For example, Haighton reported that if the editor of *The ARRL Letter* calls him asking for information, he will provide it. A suggestion was made that when this happens the *Letter* editor should be asked to forward the item to James.

Clark suggested that ANS items provide an appropriate URL for people to go to for related photos. It was agreed that the *Satellite Status* feature of ANS should be retained.

The Board unanimously agreed that Dan James should be asked to continue in his position.

Tynan asked if James could be provided with an assistant. Haighton reminded everyone that one of his objectives for 2002 is to ensure that every officer has a backup ready to step in.

### XVII. Operations Report

Pugh reported that it had been a busy year for Operations with several new satellites going up. There been few changes to the day-to-day activities such as the AMSAT nets. In response to a question from Tynan as to whether the 75 meter net is still active, Pugh announced that the East Coast net probably has more check-ins than his 20 meter net. Chaffee declared that Al Tribble, the 75 m East Coast net control, believes strongly that many persons listen in although they do not check in. Pugh agreed that he had the same impression, explaining that because of QRM in the General Class portion of 75 m it has been necessary to remain in the Advanced Class portion. He added that, on the other hand, the 20 m net meets in the General Class segment without major problems. If necessary, a small shift in frequency usually avoids confrontations. Baines offered the opinion that it might help activity if the senior officers would check in when they can, and encouraged them to do so.

Soifer commented that at the Region 2 IARU Conference, ARRL invited all member societies to participate in Field Day and noted that in 2002, it will be an all Western Hemisphere event.

In response to the statement by Tynan that Mills had incurred substantial telephone bills for AO-40 operations, Pugh said in the past his department had funded some of these expenses and perhaps his budget could be increased to accomplish this. Feller reported that Mills has been donating the expense of these AO-40 calls and declared that Saragovitz will again offer to reimburse Mills. Clark asked if Garbee and White's expenses for RUDAK operations were considered Operations or Engineering items. Pugh replied that the coordination activities come under Operations. Clark noted that Garbee had just put out $600+ to purchase a 23cm amplifier for RUDAK activities and would Pugh be asked to fund Command Station hardware? Pugh replied that he had not been asked to nor was he soliciting it. Tynan expressed the view that, if AMSAT paid for all station equipment, numerous inventory problems would result. He noted that this has happened in the past.

Clark mentioned an overlap with Paul Willmott's AO-40 telemetry data archiving on the Web site and asked if these were considered Operations expenses. Pugh said he considered them so. He added that he had recommended that Willmott receive an award of recognition for his work. Tynan asked if AO-40 is now considered to be in the operations stage. Saragovitz replied that we have always budgeted Operations, once a spacecraft is launched. Tynan recommended that Pugh obtain the information about these expenses so that his budget can be adjusted appropriately. Feller asked that the volunteers who had incurred expenses contact him to make arrangements for repayment.

### XVIII. Publications Report

VP for Publications and *Journal* Editor Tillman

reported that the accomplishments of the past year included production of CD-ROMs containing past issues of *The AMSAT Journal* and remarked that, though it's a *good product*, the demand has not yet met expectations. Saragovitz recommended that we advertise its availability. Tillman added that the infrastructure is now in place to digitally record more past issues. Daniels said if all the back issues are not on hand he can provide most of them for copying. Another recent advance is production of the *Journal* with *Adobe Page Maker* allowing us to transfer pages as .pdf files. In the coming year the physical layout of the *Journal* will be upgraded to increase its eye appeal. This fresh look should be evident in 2002. Haighton asked that he be kept informed on this.

Tillman remarked that the strategic planning process had listed specific goals for officers to achieve and that he had found the Plan beneficial in coordinating his goals with those of the other officers. He said that following the plan makes organizing the work a more efficient process. He declared that there is now a good division of labor among his helpers. They include Ron Long, W8GUS whose specialty is providing a technical review of papers, Bill Hook, W3QBC who also does editing and Andy Reynolds, WD9IYT who produces a special project for each issue. The most recent addition to the team is John Bubbers, W1GYD who is fluent in German and translates material coming from AMSAT-DL. Martha Saragovitz helps to keep things on schedule. Tillman announced that there is sufficient material on hand to fill two issues and the problem is choosing what goes in and when. As for his budget, some extra items included costs for redesigning the *Journal* and the purchase of a new optical scanner. Publication and mailing have generally been kept on schedule. The final 2001 issue will include a summary of this BoD meeting and a full report will appear in the January/February 2002 issue. In response to a suggestion that we hand out surplus past issues at hamfests, Saragovitz said that this is frequently done and it will be continued. Feller suggested that the CD-ROM containing back issues be marketed to educational institutions. Paige thought it a good idea to bundle AMSAT-NA publications on CD-ROM and offer them for a fee to clubs who would then donate them to libraries in a program similar to that used by ARRL for distributing its books. Clark suggested considering the paperless e-book publishing concept and Tillman said he would look into it. He announced that revenue from Journal advertising has increased and his budget is presently satisfactory. Saragovitz complimented Tillman's efforts in keeping *Journal* production well organized and on schedule.

### XIX. Employee Performance and Compensation Review

A closed session was held to deal with administrative matters including Saragovitz's performance review and compensation. While no record was made of this session, after the open session resumed, it was moved and seconded that Martha receive a bonus. The motion passed by a unanimous vote.

### XX. Auditor's Report

Treasurer Feller distributed the audited financial report for year 2000 prepared by the firm of Verkouteren, Auerbach, Olsen and Co. He reported the audit was in good condition and then asked for two motions, one to accept the report and the other to retain the services of the same accounting firm for the coming year.

Both proposals were approved.

### XXI. Adjustment and Approval of the Budget

Haighton noted that the major difference between year 2001 and 2002 budget is caused by the JJ project.

Tynan observed that an Income item of $300,000 in donations, seemed high to him. Haighton defended this as the amount which would be required to support JJ. Tynan questioned the approach, stating that donations should be based on reasonable expectations, rather than needs. It was generally agreed that, while the figure is probably optimistic, we should strive at attain it if JJ is to go forward as planned in the year 2002.

Daniels moved and Banes seconded a motion to approve the Budget. The motion was passed after adding $10,000 for ground station development expenses and $5,000 for Education. It was suggested that the next Auditor's Report be distributed to officers for review prior to the BoD meeting.

### XXII. Other Matters

Haighton read the report received from VP for Education Liaison Steve Bible.

Daniels declared that it is important for Bible to get in contact with Pam Mountjoy at NASA headquarters.

VP for User Services Andy MacAllister announced that the September 2001 issue of *73* magazine will be dedicated to Amateur Radio satellites.

Clark proposed a joint issue of *CQ* magazine and *The AMSAT Journal* be published in 2002.

### XXIII. Review of Action Items

- Haighton - request delegation of duties during his absence.
- Johnson - Hold JJ PDR and report results to the Board.
- Klein - Proceed in accordance with the decision reached in the closed session with regard to US Government regulations which affect AMSAT activities.
- Saragovitz - Give ISS manual to Shepard and to Baines for Area Coordinator's Toolkit.
- Haighton - Represent AMSAT-NA at Phase 5A meeting and report results to the Board.
- Daniels, Clark and Hambly - Meet with Kanawatti and Lorenzini re the proposed new small satellite project and report back to the Board.
- Haighton and Burden - Provide proceedure for updating Strategic Plan.
- Haighton - Thank Rob Zee for his very detailed and complete MOST report.
- Haighton - Talk to James re ANS.
- King, Soifer, Feller and Clark - Work with universities on Cubesats and other satellite projects.
- Tillman - Investigate possibility of a joint CQ/ AMSAT Journal issue.
- Soifer - Suggest King to Hans as AMSAT-NA's representative on the new panel of advisors.
- Feller - Distribute updated version of Budget to Board members.

### XIV. *Atta-boys* and *Atta-girls*

- Harry Yoneda, JA1ANG's physicians for getting him back in shape to attend yet another Annual Meeting.
- Builders of the new satellites Starshine (Gil Moore) PCSat (Bob Bruninga) and OPAL (Bob Twiggs).
- All of the AO-40 Command Team including Jim White and Paul Willmott.
- Al Worden for AO-40 downlink support.
- Martha and Sadie for their support at the office.
- Harold Price for GPS support.
- Those who supported AMSAT at the hamfests and other functions including Ed Collins and the team at Dayton, Richard Crow at Rochester, Larry Brown and Steve Bible at the Riverside Satellite Workshop and Jim Huhta, Rich Clark and Doug Fount at the Satellite Demo Trailer. Francis Drake AA4FD for the demonstration at the hospital.
- Bruce Paige for running the tape recorder at this meeting and for his help with the award plaques.
- The Diggs family, and all the crew who helped put on the 2001 Annual Meeting.
- The MOST team and Dr. Robert Zee for his direction of the project; and Zee for his very comprehensive report on the project.
- All the AMSAT volunteers who contributed to MOST
- Andy MacAllister's team of contributors for the November 2001 *73 Amateur Radio* magazine special satellite issue. These included Bruce Paige, Jerry Brown, Simon Lewis, James Miller, Joe Mayfield, Russ Tillman, Bob Bruninga, Frank Bauer and Robin Haighton.
- *73 Magazine Amateur Radio* magazine for devoting the issue to amateur satellites.
- Those who helped write and develop the *Area Coordinator's Toolkit* CD ROM including Chas Richards, Jim Sanford, Russ Tillman and Terry Douds.
- Bob Carpenter for his support at the AMSAT office and for providing suggestions for the President's Club campaign.
- Art Feller and Barry Baines for constructive criticism.
- The two immediate past presidents Bill Tynan and Keith Baker.
- Art Feller for his work as AMSAT Treasurer.
- Those who have brought new ideas.
- Larry Kayser for project support.
- Those at the ARRL including Joel Harrison, Paul Rinaldo and Steve Ford.
- Barbara Saragovitz for advice at the Strategic Planning meeting and Jill Barkan for help with the Business Development meeting.

### XXV. Adjournment

Chairman Tynan declared the meeting adjourned at 1128 EDT on Monday, 8 October 2001. He announced the Board will reconvene by teleconference as needed to consider matters that may come up. ■

## Tune in the Universe!

The SETI League, Inc. is pleased to announce the publication of a new book on CD-ROM by Dr. H. Paul Shuch, N6TX, its Executive Director and a respected radio amateur long involved in the microwave search for life in space. *Tune In The Universe!* is a radio amateur's guide to the Search for Extra-Terrestrial Intelligence (SETI). It is an interactive book on CD-ROM, which can be read on any computer with ordinary web-browser software (easy-to-use hypertext format). Its six sections are part history, part tutorial, and part memoir, with a mix of photos and songs to entertain as well as educate. It seeks to involve radio amateurs, amateur astronomers, and other hobbyists in a scientifically credible search for our cosmic companions. Science fiction luminary and SETI proponent Sir Arthur C. Clarke adds, "I congratulate Dr. Shuch on his lucid, comprehensive, and often very amusing account of the radio search for ETs. Perhaps, as some wit remarked, the best proof that there is Intelligent Life in Outer Space is the fact it hasn't come here. Well, it can't hide forever - one day we will overhear it."

*Tune In The Universe!* (ISBN 0-87259-854-3), copyright © 2001, is published by the American Radio Relay League (ARRL). Dr. Shuch will donate a portion of each sale to benefit the nonprofit SETI League, Inc. Cover price is $24.95 US, through the ARRL, The SETI League, Inc., and quality book vendors everywhere. Order from ARRL online <*http://www.arrl.org/catalog/?item=8543*>, or telephone toll-free US 1-888-277-5289, or elsewhere 1-860-594-0355, fax 1-860-594-0303.

## Corrected AMSAT Field Day 2001 Results

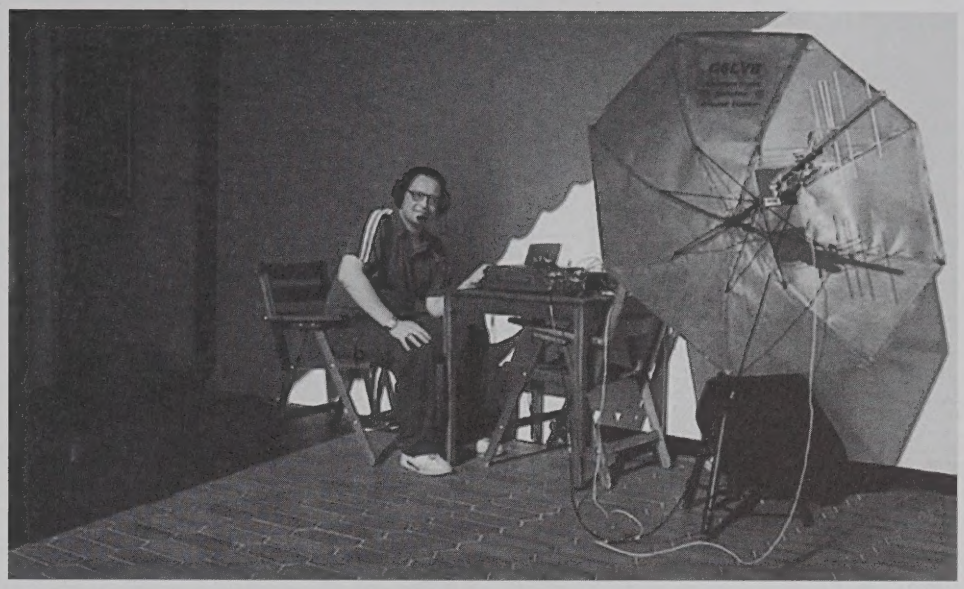
The following is a corrected version of the 2001 AMSAT Field Day competition results. The score for NX2Q - *BV The Machine* has been adjusted from 27 to 82 points. I managed to overlook all of Al's analog points!

**Corrected 2001 AMSAT Field Day Competition Results**

| Place | Call | Points | Class | Group Name |
|---|---|---|---|---|
| 1 | K4BFT | 166 | 5A | Huntsville Amateur Radio Club |
| 2 | K5OE | 103 | 1E | Jerry Brown |
| 3 | KE4AZN | 100 | 1E | Mike Kingery |
| 4 | AA4MD | 99 | 1B | Satellite Trailer Boys |
| 5 | W2LV | 97 | 4A | Sussex County Amateur Radio |
| 6 | ON5LL | 89 | 2A | PE1RAH + ON1DLL |
| 7 | NX2Q | 82 | 1A | BV The Machine |
| 8 | VE3KRG | 77 | 2A | Kawartha Amateur Radio Grp |
| 9 | K6YK | 77 | 1D | John Lee |
| 10 | K9KM | 74 | 2A | Lake County RACES |
| 11 | K2BMI | 72 | 1B | Keplerian Contest Club |
| 12 | W9REG | 45 | 3A | Tippecanoe Amateur Radio |
| 13 | XE2AT | 39 | 1B | Alvaro De Leon (ex-XE2YVW) |
| 14 | W8MRM | 29 | 2A | Motor City Radio Club |
| 15 | K5ENG | 28 | 2A | Houston AMSAT + ATV Soc |
| 16 | K4RS | 27 | 2A | Fort Pierce & Vero Beach ARC |
| 17 | N1SF | 24 | 4A | N1SF Radio Club |
| 18 | W6VOM | 20 | 2A | Alameda Cnty Sheriff's Comm |
| 19 | AI5TX | 11 | 2A | Armadillo Intertie |
| 20 | K8AYZ | 10 | 4A | L'Anse Creuse ARC |
| 21 | W0WTN | 9 | 3A | Lake Area Radio Klub |
| 22 | KK5DO | 7 | 1D | Bruce Paige |
| 23 | K6HAI | 6 | 3A | North Shores ARC |
| 24 | W3HZW | 5 | 3A | Recon Delta |
| 25 | N1EV | 4 | 3A | Greater Norwalk ARC |
| 26 | AL7EB | 2 | 1E | Ed Cole |

Tim N8DEU accepted the 1st Place plaque for K4BFT at the AMSAT Space Symposium in Atlanta. Jerry K5OE received a certificate for his first place total for home operation on emergency power. Jim AA4MD and *The Satellite Trailer Boys* will receive a certificate for their 2nd place score for portable operation
using emergency power, and W2LV The Sussex County ARC will receive a certificate for their third place portable/emergency power showing.

Thanks to all for participating, and good luck with Field Day 2002! (And yes, ISS QSO's will be allowed!)
73,
Andy MacAllister, W5ACM



**Have dish, will travel! After successfully demonstrating his portable and innovative AO-40 station at the AMSAT Symposium in Atlanta last October, Howard Long G6LVB travelled to Monaco for another AO-40 DXpedition. Despite battling the constant lure of French cuisine, G6LVB managed to have much success on AO-40.**

## 3A/G6LVB on a Weekend!

This was my second go at a one-man DXpedition to Monaco (3A) (or any DXpedition come to think of it). This time I had my act together. Had I timed things a little better and tried a little harder I might have made WAC in two afternoons. Unfortunately besides Amateur Radio (and the YL of course) I have some other high priorities in my life: red wine, French cheese and, well, any French cooking at all as long as it doesn't consist of pond life. So I didn't make it to the microphone as much as I'd thought.....

As it was I made 15 countries including some US, Australia, lots of Japan, lots of Europe and it turns out I missed South Africa by the skin of my teeth. No South America heard at all. Anyway, I must apologize to everyone who tried or waited or listened for me but failed. Conditions were very changeable. In the end I gave up on three occasions when squint was bad and another bottle of vin rouge and a plate of fromage appeared.

It may not sound very pecular, but I'm afraid my 50W and 12dBic on the U-band uplink was most certainly not enough all the time particularly at squints less than 10 deg or so. The S-band beacon was still booming in but I wasn't. In retrospect I should have tried switching uplink polarization in these circumstances. I'm starting to wonder if the U-band uplink AGC is permanently stuck on -8dB, whether there's a signal or not! By far the best signals I heard were shooting less than 1kW EIRPc on L-band. Nothing new there! There seem to be more and more stations heading to L-band....

Also I found a new (for me) propagation situation. As the satellite came over the horizon over the Mediterranean (I had a view directly over the Med iterranean at the shoreline), I suffered big QSB for the first five degrees or so of elevation. My guess is that this was simply the combination of the reflected(or refracted) and direct waves on S-band. The period was of the order of a minute or so. But it made it impossible to copy signals at times, with the beacon itself showing similar S5 to S9 swings. Above 7 or 8 degrees and there was no problem - maybe the reflected waves were no longer getting to the feed point as they were out of the beamwidth.

Again many thanks to everyone for making a great weekend for me and apologies to those who tried but didn't make it.
73,
Howard Long, G6LVB

## Stop Press

(18JAN02) At an AMSAT-NA Board of Directors teleconference held on 17 January 2002, it was decided to add to the list of current projects. After extensive discussion and by a unanimous vote of the Board, a new Low Earth Orbit Micro-Satellite project was approved. This microsat will provide amateurs access using only a handheld transceiver, in the 2m and 70 cms bands and with several distinct channels. There will be several channels available so that simultaneous communications may take place. The Microsat will be powered by using efficient solar cells. In addition to the "Bent Pipe" operations the Microsat will carry one or more experimental modes which are currently being determined. More details will be forthcoming over the next few weeks. During the teleconference Immediate Past President, Keith Baker, KB1SF offered to accept the position of Executive Vice President, a position which had not been filled at the Atlanta meeting of the Board of Directors. President Robin Haighton welcomed Keith's offer and which was unaminously accepted.

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